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# DELAWARE RIVER BASIN

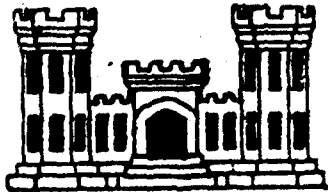
## SWINGING BRIDGE DAM

SULLIVAN COUNTY, NEW YORK

INVENTORY NO. N.Y. 696

### 6 PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

Swinging Bridge Dam (Inventory Number NY-696),  
Delaware River Basin, Sullivan County,  
New York. Phase I Inspection Report.



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11 George Koch

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NEW YORK DISTRICT CORPS OF ENGINEERS

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## REPORT DOCUMENTATION PAGE

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization. The examination of documents and visual inspection of Swinging Bridge Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to life or property. The dam, however, has a number of deficiencies which if not remedied, may have the potential for developing into hazardous conditions. These deficiencies are as follows:		

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1. Seepage at the toe and along the east abutment of the dam was evident. A depression was observed in the downstream slope above the original penstock near the center of the dam. Investigation of these conditions must be completed within 6 months of notification, and monitoring devices to measure flow and movement must be installed immediately with recording of information at weekly intervals until completion of the investigation.
2. Structural cracking of the gate tower (reportedly due to ice loading) and deterioration of the spillway slabs and flood gate supports was noted. Investigation of these conditions must be completed within 1 year of notification and repairs completed within the next construction season.
3. Removal of tree and vegetative growth observed in the spillway channel, on the spillway channel slopes, on the embankment slopes, at the abutment contacts and along the toe of the dam is required, and must be completed within this construction season.
4. Repair the depressions noted on the crest of the embankment (western end) and on the upstream slope near the watch tower during this construction season.
5. Initiate a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference and develop an operations manual.

→ The discharge capacity of the spillway and the adjacent bedrock channel at both ends of the spillway is adequate to pass the Probable Maximum Flood (PMF = 47,800 cfs), without overtopping of the embankment portion of the dam, which is located approximately 1,000 feet southeast of the spillway. The maximum reservoir level during the PMF will be nearly equal to the top of the embankment at elevation 1080. The actual spillway capacity is only 39% of the PMF. However, the adjacent non-erodible bedrock channel at the north and south ends of the spillway will provide the additional capacity necessary to discharge the outflow from the PMF.



## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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PHASE 1 INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM  
SWINGING BRIDGE DAM I.D. No. NY-696  
DEC #148D - 155  
DELAWARE RIVER BASIN  
SULLIVAN COUNTY, NEW YORK

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PHASE 1 REPORT  
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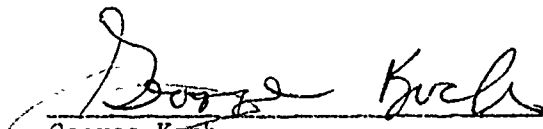
Name of Dam: Swinging Bridge Dam (I.D. No. NY-696)  
State Located: New York  
County Located: Sullivan  
Stream: Mongaup River (tributary of Delaware River)  
Dates of Inspection: November 8, 1978 and April 20, 1979

ASSESSMENT

The examination of documents and visual inspection of Swinging Bridge Dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to life or property. The dam, however, has a number of deficiencies which if not remedied, may have the potential for developing into hazardous conditions. These deficiencies are as follows:

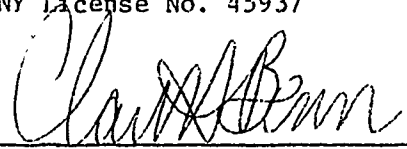
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2. Structural cracking of the gate tower (reportedly due to ice loading) and deterioration of the spillway slabs and flood gate supports was noted. Investigation of these conditions must be completed within 1 year of notification and repairs completed within the next construction season.
3. Removal of tree and vegetative growth observed in the spillway channel, on the spillway channel slopes, on the embankment slopes, at the abutment contacts and along the toe of the dam is required, and must be completed within this construction season.
4. Repair the depressions noted on the crest of the embankment (western end) and on the upstream slope near the watch tower during this construction season.
5. Initiate a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference and develop an operations manual.

The discharge capacity of the spillway and the adjacent bedrock channel at both ends of the spillway is adequate to pass the Probable Maximum Flood (PMF = 47,800 cfs), without overtopping of the embankment portion of the dam, which is located approximately 1,000 feet southeast of the spillway. The maximum reservoir level during the PMF will be nearly equal to the top of the embankment at elevation 1080. The actual spillway capacity is only 39% of the PMF. However, the adjacent non-erodable bedrock channel at the north and south ends of the spillway will provide the additional capacity necessary to discharge the outflow from the PMF.

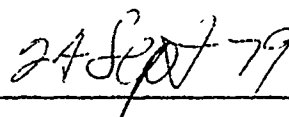
  
George Koch

Chief, Dam Safety Section  
New York State Department  
of Environmental Conservation  
NY License No. 45937

Approved By:

  
Col. Clark H. Benn  
New York District Engineer

Date:

  
24 Sept 79



Overview of Swinging Bridge Dam

Photo #1

PHASE 1 INSPECTION REPORT  
NATIONAL DAM SAFETY PROGRAM  
SWINGING BRIDGE DAM I.D. No. NY-696  
DEC #148D - 155  
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SULLIVAN COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase 1 inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection

Evaluation of the existing conditions of the subject dam to identify deficiencies and hazardous conditions, determine if they constitute hazards to life and property and recommend remedial measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenant Structures

The Swinging Bridge Dam is a 975 feet long hydraulically placed earth dam with a spillway located approximately 1000 feet northwest of the dam. The maximum height of the dam is 135 feet. The upstream slope is 1 vertical on 3.5 horizontal, the downstream slope is 1:2.5 and the crest width is 25 feet. The dam is composed of a clay and fine sand core extending from the center of the crest with slopes of 1:1 to the original grade, a core trench with maximum dimensions of 50 feet wide, 10 feet deep (side slopes = 1:1), an outer zone of boulders, gravel and sand, and rockfill toes, the material of which was obtained from spillway excavation. All exposed surfaces of the embankment were riprapped.

An intake located at the toe of the upstream slope and a gate tower located in the upstream face of the dam control the flow through the 10 foot diameter penstock to the number 1 generator. Two 24 inch diameter pipes serve as reservoir drains and are located in the conduit below the penstock. A second penstock and intake was installed at a later date near the west abutment of the dam to provide flow to generator number 2. This penstock is 10 feet in diameter. Both generators are located at the toe of the dam. The spillway is founded on sandstone. Five electrically operated flood gates each 22.6 feet wide and 6 feet high control the flow thru the spillway. Flashboards located on the north end of the flood gates are 122 feet long and 6 feet high.

b. Location

Swinging Bridge Dam is located on the Mongaup River, a tributary of the Delaware River, about 2 miles northwest of the Village of Forestbury and 7 miles southwest of the City of Monticello.

c. Size Classification

The dam is 135 feet high and stores 36,800 acre-feet of water. It is classified as a "large" dam (in excess of 100 feet).

d. Hazard Classification

The dam is classified as high hazard because of its location, about 11 miles north of the Village of Mongaup and upstream of 2 other large dams.

e. Ownership

The dam is owned and operated by Orange and Rockland Utilities Inc., 1 Blue Hill Plaza, Pearl River, NY, 10955, Tel: (914) 627-2410 -r (914) 343-0621.

f. Purpose of the Dam

The dam provides storage for power development. Recreation is permitted except at the southern end of the reservoir where the dam and spillway are located.

g. Design and Construction History

The dam was designed in 1925 by Charles H. Tenny & Co., Engineers, 200 Devonshire Rd., Boston, Mass. for the Catskill Power Corporation, Middletown, NY. The dam was constructed in 1929 by Fred T. Ley Inc., Central Contractor, Boston, Mass. The second generating plant and penstock system was constructed in 1938.

h. Normal Operating Procedures

Water releases from the Swinging Bridge Reservoir are passed through either of the two penstock systems from intakes to the generating stations located at the toe of the dam. Generation discharges are intended to maximize power development and minimize spillage through the spillway section. The generating capacity of the Swinging Bridge Reservoir is supplemented from Toronto and Cliff Lake Reservoirs by use of conduits. (See Section 4 - Operation and Maintenance Procedure).

1.3 PERTINENT DATA

a. <u>Drainage Area</u> (sq. mi)	118
Height of dam (feet)	135
b. <u>Discharge at Dam Site</u> (cfs)	
Maximum known Flood	9,143 in August 1955
Spillway at Design Pool (El. 1073*)	23,600
Spillway at Maximum Pool (El. 1080*)	-
Maximum Capacity of Reservoir drains	2-24" 80 C.F.S.
Total Discharge, Max. Pool	-
Average Daily Discharge	Varies
Maximum Capacity of Penstock	2 X 585 = 1170
c. <u>Elevation</u> (ft. above MSL-Datum)	
Top of Dam	1080
Design Pool	1073
Spillway Crest	1065
Tailrace Channel	938.5
Tailwater Elevation	945.5
Invert Reservoir Drain Inlet	951
Unit #1 Invert Penstock Inlet	964.5
Unit #2 Invert Penstock Inlet	1015



- d. Reservoir  
Length of maximum Pool, Miles 7  
Length of Shoreline (Spillway Crest) miles 15.23  
Surface area (Top of Flashboards (1070)) acres 1000
- e. Storage, (Acre-feet)  
Spillway Crest 27,350  
Maximum Design Pool 34,700  
Top of Dam -
- f. Dam  
Type: Hydraulic Fill (Earth fill)  
Length (ft.) 975  
Upstream slope 3.5:1  
Downstream slope 2.5:1  
Impervious Core Clay and Fine Sand.  
Crest elevation, ft. 1080  
Crest Width, ft. 25  
Grout Curtain None
- g. Spillway  
Type: Comb. Flashboards & Gates (125' each)  
Length, ft. 250'  
Crest Elevation MSL 1065  
Upstream Channel Natural Rock  
Downstream Channel Natural Rock & Concrete
- n. Regulating Outlet  
Unit #2 - 10' diameter penstock, shape inverted "U";  
Unit #1 - 10' diameter penstock.
- l. Reservoir drain  
2-24" pipe.

## SECTION 2: ENGINEERING DATA

### 2.1 DESIGN

#### a. Geology

The Swinging Bridge Dam is located in the "Appalachian Uplands" physiographic province of New York State. This province (northern extreme of the Appalachian Plateau) was formed by dissection of the uplifted but flat lying sandstones and shales of the middle and upper Devonian Catskill Delta. Relief is high to moderate. Maximum dissection occurs in the Catskill Mountain area, where only the mountain peaks approximate the original plateau surface. Drainage is generally south or southwest toward the Delaware River system.

#### b. Subsurface Investigation

A subsurface investigation was conducted and this information has been included in Appendix F - Drawings #KK 3-16 and KK 3-18. In general, the borings indicate that the soils at this site are of glacial till origin (sand, clay and stone of varying mixtures), over shale and sandstone bedrock.

The "General Soil Map of New York State" prepared by Cornell University Agriculture Experiment Station indicates that the surficial soils are of the Lackawanna series. This soil series has poor internal drainage characteristics. Boulders are common and depth to bedrock is variable. Sandstone bedrock was observed outcropping in the excavated spillway channel.

#### c. Dam and Appurtenant Structures

The dam was designed by Charles H. Tenny, 200 Devonshire Rd. Boston, Mass. All drawings available have been included in Appendix F. The design of the dam includes a hydraulically placed core of clay and sand with adjacent zones of boulders, gravel and sand, and slopes protected by riprap. Rockfill toes using spillway excavation material was incorporated in the design. The dam has a core trench which extends to "impervious material", with maximum dimensions of 50 feet wide and 10 feet deep. The spillway is located approximately 1000 feet northwest of the dam and is founded on sandstone bedrock.

### 2.2 CONSTRUCTION RECORDS

No information regarding the construction of the dam was available other than the year of completion and the contractor, that being 1929 and Fred T. Ley Inc. A second generating system was completed in 1938.

### 2.3 OPERATION RECORD

All information concerning operation and maintenance of the dam is on file at the power house.

### 2.4 EVALUATION OF DATA

Some of the data presented in this report has been made available by representatives of Orange and Rockland Utilities Inc. This information has been invaluable in the preparation of this report. All information gathered appears to be adequate and reliable for Phase 1 Inspection purposes.

### SECTION 3: VISUAL INSPECTION

#### 3.1 FINDINGS

##### a. General

Visual inspection of Swinging Bridge Dam and the surrounding watershed was conducted on November 8, 1978 and April 20, 1979. The weather was clear and the temperature ranged in the fifties. The reservoir level at the time of inspection was 1064.5, 15.5 feet below the top of the dam.

##### b. Embankment

The earth embankment shows no signs of major distress. However, the following conditions were observed: A minor depression was evident on the crest near the west end of the embankment. No signs of active movement were observed and the alignment of the crest appeared good. A depression was observed on the downstream slope approximately one-third the slope length from the toe and above the penstock. This depression is approximately 10 feet in diameter with a maximum depth of 2 feet. No evidence of current movement was apparent. A third depression was observed on the upstream slope near the watch tower structure. This depression is approximately 10 feet by 15 feet with a maximum depth of 1 foot. No evidence of on-going movement was discovered. The cause of this depression is most likely wave action from the reservoir. Numerous small trees and vegetation were observed on the slopes, at the abutment contacts and along the toe of the dam. No erosion or seepage was discernible on the slopes or at the abutments of the dam. No evidence of subsidence, depressions, or movement was present in the downstream area below the dam. Numerous areas of seepage emerged in this area and are described in the following sub-section. As a consequence of this seepage, the surfacial soils in the vicinity were soft, particularly on the west side of generation station #1.

##### c. Seepage

Five zones of seepage were observed at and below the toe of the dam and along the original grade near the east abutment. Section 3-e of the "Visual Inspection Checklist" - Appendix C contains a sketch of these areas; the following numbers correspond to the numbers shown in the Appendix.

- 1) A catch basin north of generation station #1 between the access road and the toe of the dam was observed. Examination of this basin revealed flow at a rate of approximately 10 gallons per minute (gpm) entering the basin from a drain which extends eastward along the toe of the dam and partially up the east abutment. Flow from the catch basin is directed under the access road toward the generation building. No evidence of particle migration or sedimentation within the catch basin was observed.
- 2) Near the southwest corner of generation building #1, a 6 inch diameter pipe was placed to collect seepage water. This pipe was not taking the full flow and water was by-passing the pipe along the west side. This area was very wet and the soil very soft. Flow was estimated to be 10 gpm through the pipe and 10 gpm by-passing the pipe. The source of the seepage is unknown and no transportation of fine soil material was noted (Photo #10).

- 3) Approximately equidistant from the generation buildings and below the access road, a 4 inch diameter pipe was exiting from the slope. A metal container, presumable used to collect or measure flow, was placed beneath the outlet of this pipe. No flow was observed and its previous performance is uncertain. (Photo #9).
- 4) Seepage was noted exiting from and in the vicinity of two 15 inch diameter pipes located in a swale area (original grade) southeast of the toe of the dam below an abandoned camp. Flow is estimated to 10 gpm with no migration of soil particles. The two pipes appear to have provided control of run-off along the east abutment, but are now plugged with soil and vegetation (Photo #12 and 12).
- 5) A wet area was encountered near and beneath the northeast corner of the abandoned camp. No flow was observed exiting this level area (Photo #13).

Maintenance personnel reported observing the seepage as described above for their duration of employment at the site.

d. Spillway

Considerable concrete spalling and deterioration was observed on the flood gate supports and the spillway slabs. In certain areas, the spalling has progressed to the point where reinforcing bars are exposed. This spalling appears to be related to exposed surfaces where ice and water have initiated deterioration. Leaking of flashboards was also noted. Considerable tree growth was observed in the tailrace channel and along the channel slopes. The flood gate system was reported to be operational.

e. Regulating Outlets

All reservoir drains, power generation systems, and associated valves were reported operational. The gate tower located in the upstream face of the dam was examined, and structural cracking of the concrete was discovered 84.8 feet below the tower floor at Elevation 995.2. This cracking was reported to be a result of ice pressure from the reservoir. Steel straps, secured to the concrete on either side of the cracked areas, were installed to insure the integrity of the structure. Calcification was also apparent on the walls of the tower at various locations.

f. Downstream Channel

The downstream channel appears to be in good condition. Since the spillway and outlet channel foundations are sandstone bedrock, the condition of the downstream channel will probable not influence the performance of the spillway and appurtenances.

g. Reservoir

There are no visible signs of instability or sedimentation problems in the reservoir area.

## 3.2

EVALUATION OF OBSERVATIONS

Significant conditions were observed which require immediate investigation to determine the type of corrective action necessary to insure the stability of the dam and appurtenances. The following is a summary of the problem areas encountered, in order of importance.

1. The seepage observed at various locations at or near the toe of the embankment and along the east abutment.
2. The depression observed on the downstream slope above the penstock (10 feet in diameter, 2 feet deep maximum).
3. The cracking noted in the gate tower.
4. The deterioration of concrete located on the spillway slabs and flood gate supports.
5. Tree and other vegetative growth noted in the spillway channel, at the abutments and along the toe of the embankment.

These conditions do not represent any imminent danger, however, remedial action must be undertaken to prevent the development of hazardous conditions.

## SECTION 4: OPERATION AND MAINTENANCE PROCEDURE

### 4.1 PROCEDURE

The Swinging Bridge Dam is a power generating dam for Orange and Rockland Utilities Inc. Two penstocks carry water from the reservoir to the two power plants located at the toe of the dam. Flow through the 10 feet diameter penstock to generating station #1 is controlled by an 8 feet diameter remote controlled electrically operated butterfly valve, located in the gate tower. Below this valve, two 24 inch diameter gate valves serve as reservoir drains. Flow through the 10 feet diameter penstock to generating station #2 is controlled by a remote controlled electrically operated butterfly valve located in the gate house at the northwest corner of the embankment. This penstock is connected to a surge tank. In addition, flow at the entrance to each generator can be controlled by wicket gates.

Five flood gates located on the south end of the spillway control the discharge not utilized for power generation. These gates are operated by electric motors placed on the bridge above the gates.

Two water supply conduits, one from Cliff Lake Reservoir and one from Toronto Reservoir, augment the storage capacity of Swinging Bridge Reservoir, so that during low flow conditions, power can still be generated.

All valves are remote controlled by the systems operator located on Dolson Avenue, Middletown, NY.

### 4.2 MAINTENANCE OF DAM

The operation and maintenance manual and records for the facility are on file in the generating building. Maintenance of the dam appears to be adequate with the exceptions noted in "Section 3: Visual Inspection". Maintenance of the spillway is inadequate in as much as deterioration of concrete surfaces is well advanced.

### 4.3 MAINTENANCE OF OPERATING FACILITIES

Maintenance of generating equipment and associated valves, conduits, etc., appear to be excellent.

All valves are reported to be operational. No operations manual is on file. A record of maintenance operations is on file with the maintenance staff.

### 4.4 WARNING SYSTEM IN EFFECT

An excellent warning system has been developed by the owner, in accordance with the Federal Energy Regulating Commission standards. This system was recently updated (Dec. 7, 1978) and is included in Appendix F.

### 4.5 EVALUATION

Certain remedial measures are required to provide the proper maintenance. Deterioration of concrete surfaces in the spillway system, and cracking in the gate tower are areas which need further maintenance. Vegetative growth in the spillway channel and at the dam must be removed.

## SECTION 5: HYDRAULIC/HYDROLOGIC

### 5.1 DRAINAGE AREA CHARACTERISTICS

The Swinging Bridge Dam is located on the Mongaup River, a tributary of the Delaware River. The drainage area at the dam site is 118 square miles. The topography is characterized by steep slopes interspersed by swamps, ponds and lakes.

### 5.2 ANALYSIS CRITERIA

Information on the Standard Project Flood (SPF) for the Swinging Bridge Dam and its watershed was obtained from the "Upper Delaware River Basin Hydrologic Flood Routing Model" prepared in 1976 by Water Resources Engineers, Inc. for the New York District of the U.S. Army Corps of Engineers. The rainfall-runoff mathematical model HEC-1 developed by the U.S. Army Corps of Engineers was used to reconstruct major floods and to simulate the SPF considered in the study. SPF is approximately one-half of Probable Maximum Flood (PMF).

The Swinging Bridge Dam watershed is located within the subbasin 50 of the Delaware River Basin. The inflow was routed through the reservoir and the peak outflow was determined to be 23,900 cfs for the SPF.

### 5.3 SPILLWAY CAPACITY

The spillway is 122 feet long and is topped by 6 feet high flashboards. There are 5 electrically operated floodgates, each 22.6 feet wide, located south of the spillway. The capacity of the spillway and floodgates is 18,600 cfs with the flashboards removed and gates completely opened.

### 5.4 RESERVOIR CAPACITY

The reservoir capacities at the crest of spillway, and at the top of the flashboards are 27,400 acre-feet (AF) and 34,100 AF respectively. The storage capacity curve is shown in Appendix D. The curve indicates a surcharge storage of 4,400 AF which is equivalent to a runoff depth of 0.70 inches over the drainage area.

### 5.5 FLOODS OF RECORD

**Maximum flood recorded** is 9100 cfs on August 1955.

### 5.6 OVERTOPPING POTENTIAL

The maximum combined capacity of the floodgates and spillway is 18,600 cfs compared to a SPF of 23,900 cfs. Hence, the floodgates and spillway can pass 78 percent of the SPF. Since the SPF is approximately one-half of PMF, the floodgates and the spillway are capable of passing only 39 percent of PMF (47,800 cfs). The adjacent non-erodable bedrock channel which extends to the north and south at the ends of the spillway will provide additional discharge capacity. This additional capacity will be such that the reservoir level will approximate the top of embankment (elevation 1080) during the PMF. Therefore, no overtopping of the dam will result.

### 5.7 EVALUATION

The spillway and adjacent bedrock channel is adequate to pass the PMF, and no overtopping of the earth embankment section, approximately 1000 feet southeast of the spillway, will result.

## SECTION 6 STRUCTURAL STABILITY

### 6.1 EVALUATION OF STRUCTURAL STABILITY

#### a. Visual Observations

The following visual observations indicate distress within the earth embankment, although these observations do not indicate conditions which pose an immediate hazard to human life or property:

1. Seepage at the toe and along the east abutment.
2. Depression on the downstream slope above the penstock (10' diam, 2' deep).

The following visual observations indicate deterioration or distress in the concrete elements of the dam, but do not pose an immediate hazard to life or property:

1. Cracking of the gate tower due to reservoir ice loading.
2. Deterioration of concrete at the spillway slabs and flood gate supports.

#### b. Design and Construction Data

No design computations or construction information regarding the structural stability of the dam are available.

#### c. Operating Records

No operational problems were reported which would influence the stability of the structure.

#### d. Post-Construction Changes

A second generating system was installed in 1938 with the intake at the western edge of the embankment. Steel straps, used to repair the cracking of the gate tower, were installed in 1971.

#### e. Seismic Stability

Seismic forces in this zone are not considered to be of significant magnitude to influence the stability of the structure.



## SECTION 7: ASSESSMENT/RECOMMENDATIONS

### 7.1 ASSESSMENT

#### a. Safety

The Phase 1 Inspection of Swinging Bridge Dam did not indicate conditions which constitute an immediate hazard to human life or property. The embankment is not considered to be unstable. However, seepage along the toe of the dam and at the east abutment, and the depression on the downstream face above the original penstock, require investigation and observation at periodic intervals to prevent the development of hazardous conditions. In addition, deterioration of the spillway concrete and structural cracking of the gate tower must be investigated and repairs instituted.

#### b. Adequacy of Information

The information reviewed is adequate for Phase 1 Inspection purposes.

#### c. Urgency

Investigation of the observed seepage and depression must be completed within 6 months of notification to the owner. In addition, weirs should be immediately constructed and measurements taken to monitor the flow of the seepage at all locations. Investigation of the structural cracking in the gate tower and deterioration of concrete on the spillway slabs and flood gate supports must be completed within 1 year of notification and repairs completed within the next construction season. Tree and other vegetative growth noted in the spillway channel, at the abutments and along the toe of the embankment must be removed during this construction season.

#### d. Need for Additional Investigations

To prevent the development of potentially hazardous conditions, investigations are required in the following areas:

1. Seepage at toe and along east abutment of the dam.
2. Depression observed on the downstream face of the dam above the penstock.
3. Structural cracking of the gate tower and deterioration of concrete on the spillway slabs and flood gate supports.

### 7.2 RECOMMENDED MEASURES

- a. Results of the aforementioned investigations will determine the type and extent of remedial measures required for the observed seepage, depression, structural cracking and concrete deterioration.

The following improvements can be accomplished by maintenance forces:

- b. Remove the tree and vegetative growth observed in the spillway channel and on the spillway slopes, on the embankment slopes, at the abutment contacts, and along the toe of the dam.

- c. Repair the depressions noted on the crest of the embankment (western end) and on the upstream slope near the watch tower.
- d. Initiate a program of periodic inspection and maintenance of the dam and appurtenances. Document this information for future reference. Also develop an operations manual.

APPENDIX A

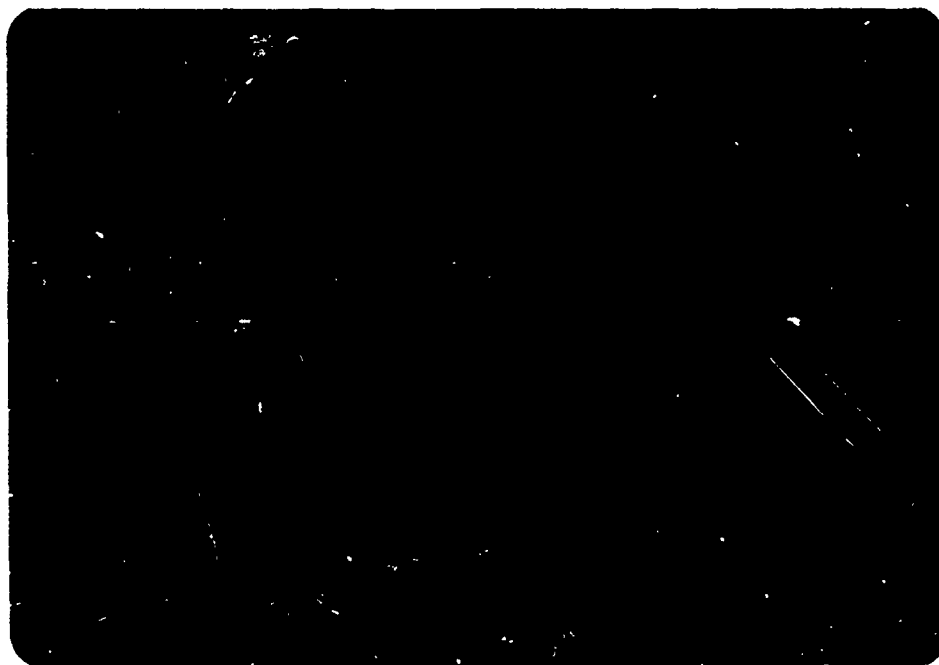
PHOTOGRAPHS



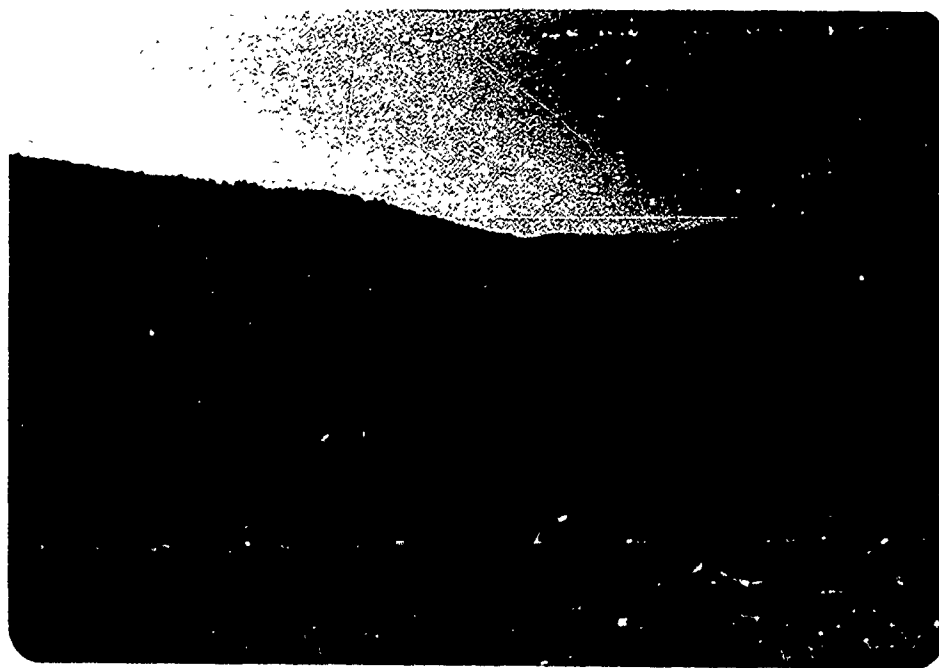
Upstream slope looking west  
at Intake #2  
Photo #2



Upstream slope looking east  
note depression in riprap  
Photo #3



Gate Tower for Intake #1  
Photo #4



Downstream Channel  
viewed from top of dam  
Photo #5



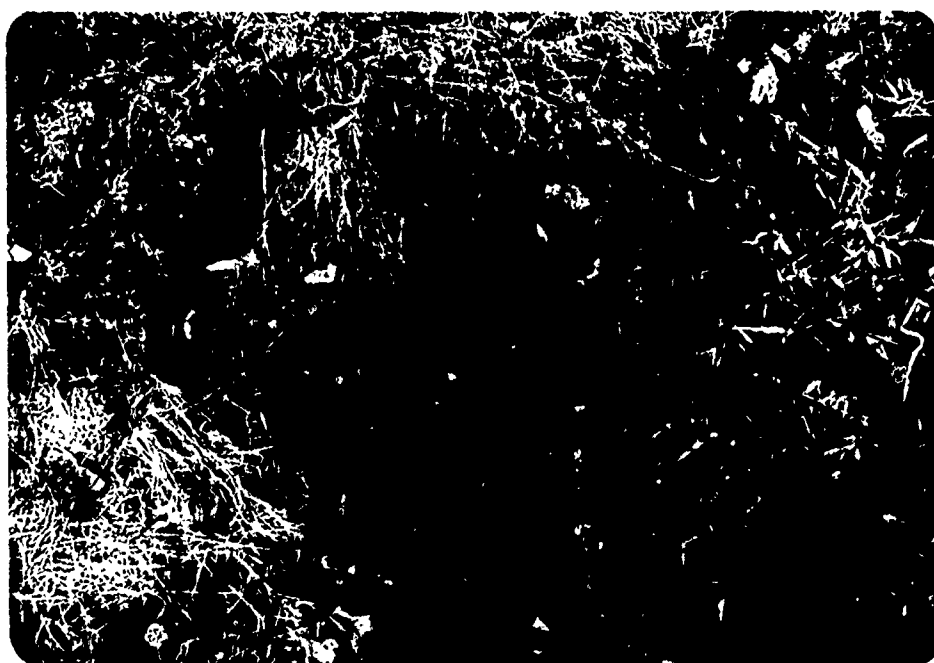
Downstream Slope  
looking east  
Photo #6



Downstream Toe & Generator #1  
looking east  
Photo #7



Depression in Downstream Slope  
above penstock #1  
Photo #8

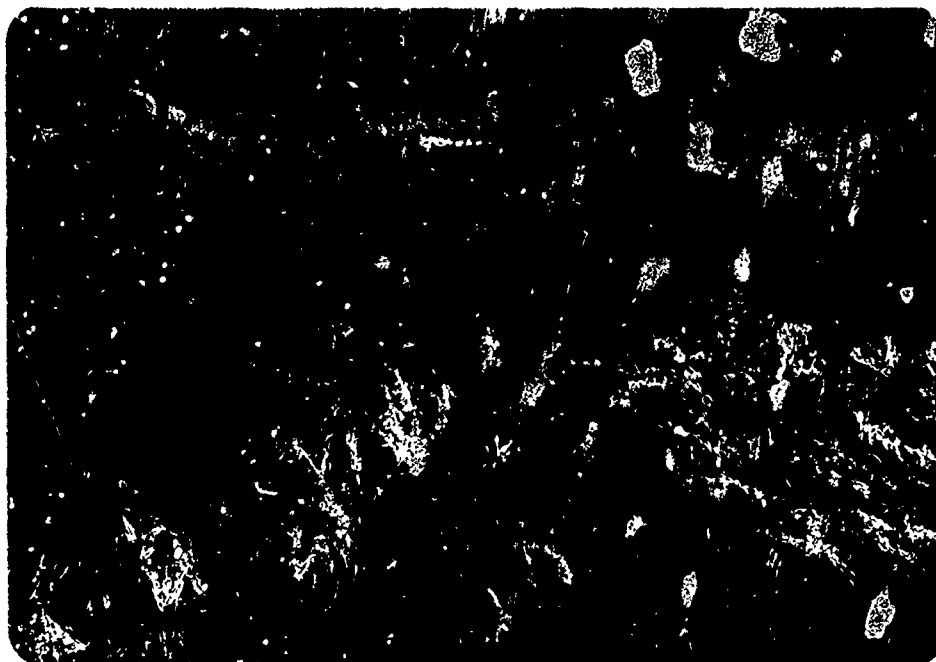


Seepage Collector (inactive)  
Seepage point #3  
Photo #9

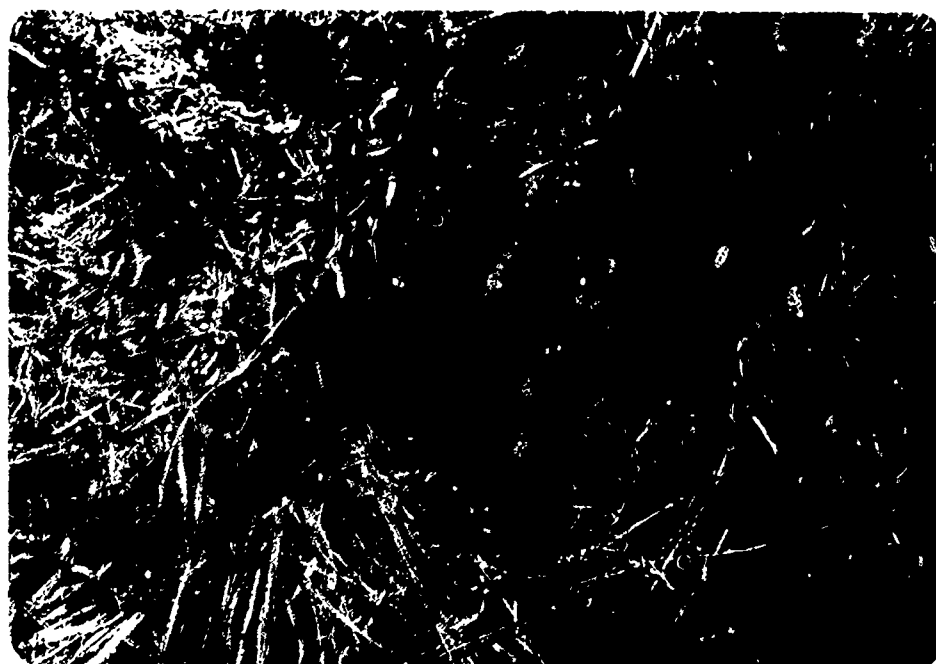


Seepage near Southwest Corner of Generator #1  
 Seepage point #2  
 Photos #10 A&B





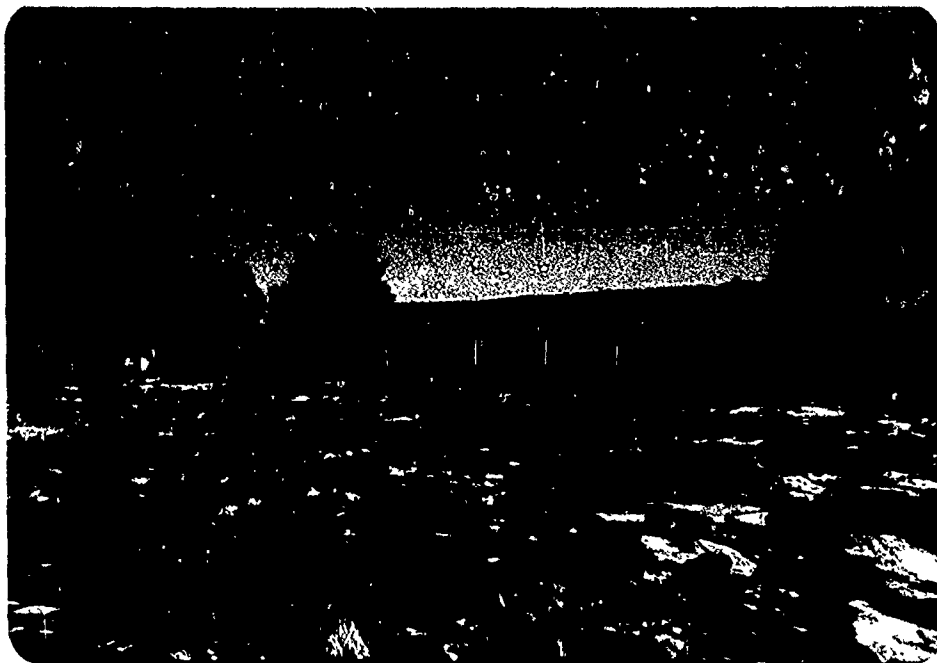
Seepage Point #4  
East Abutment Area  
Photo #11



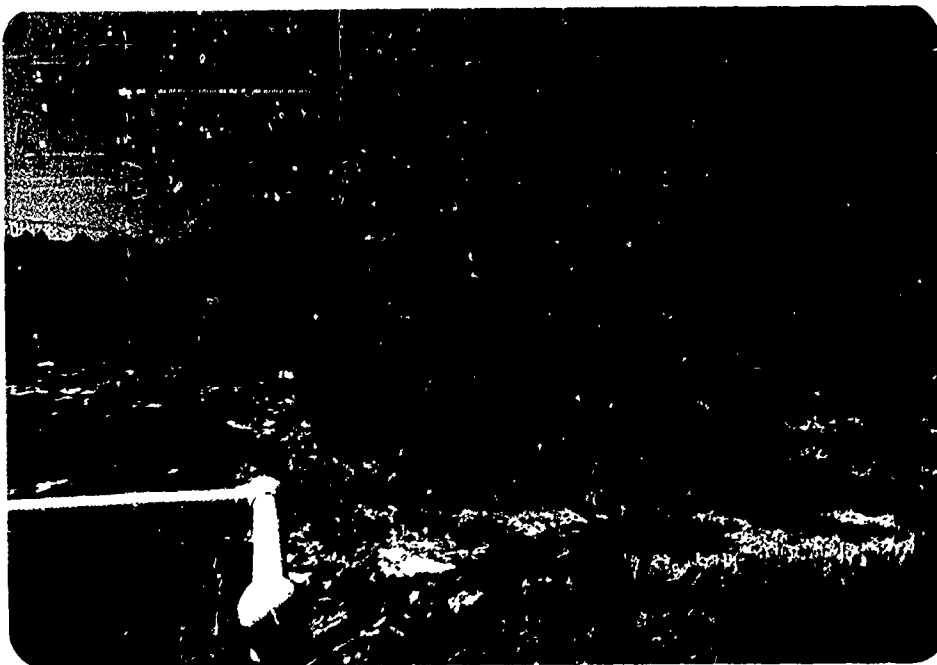
Seepage Point #4  
Note seepage at 15" pipe  
Photo #12



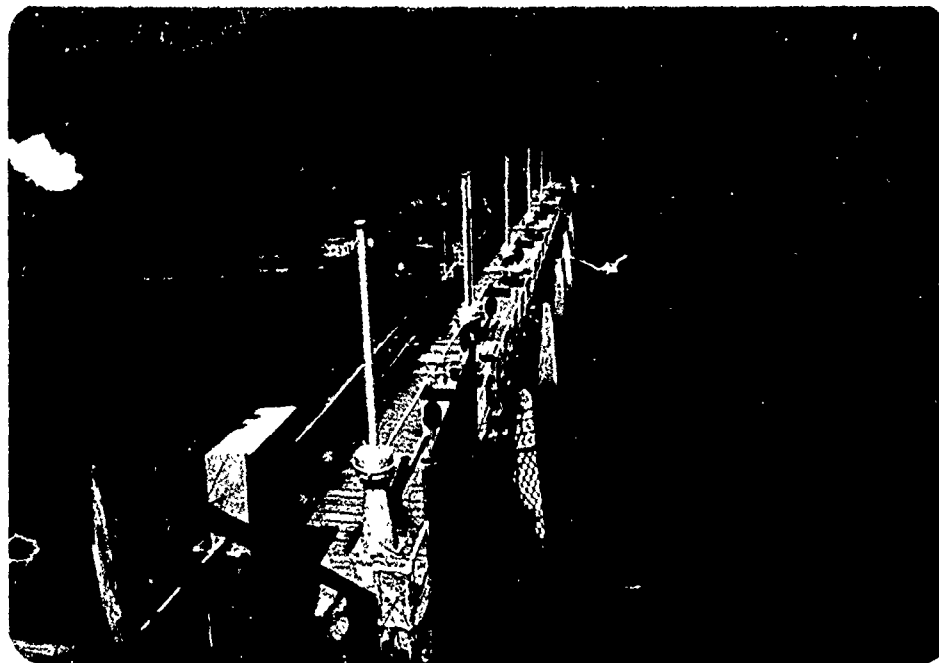
Seepage Point #5  
Near abandoned camp  
Photo #13



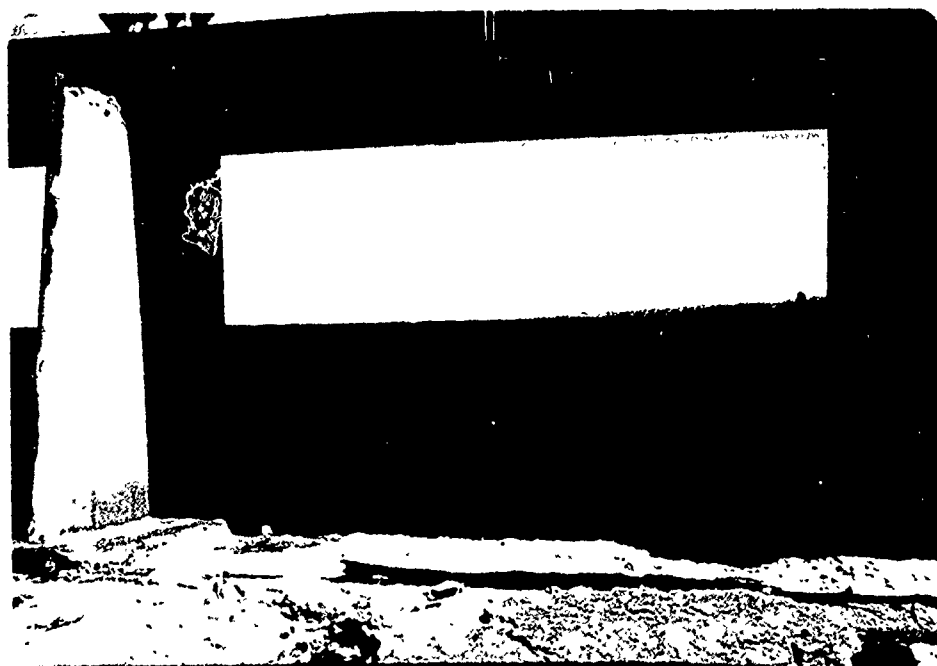
Spillway Viewed from Downstream Channel  
Photo #14



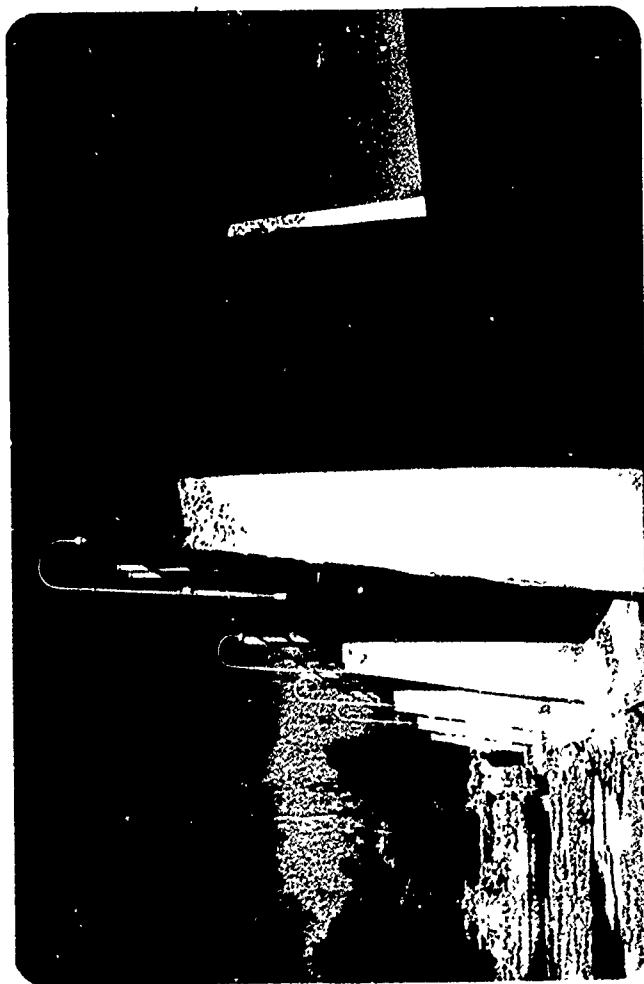
Downstream Channel Viewed from Spillway  
Photo #15



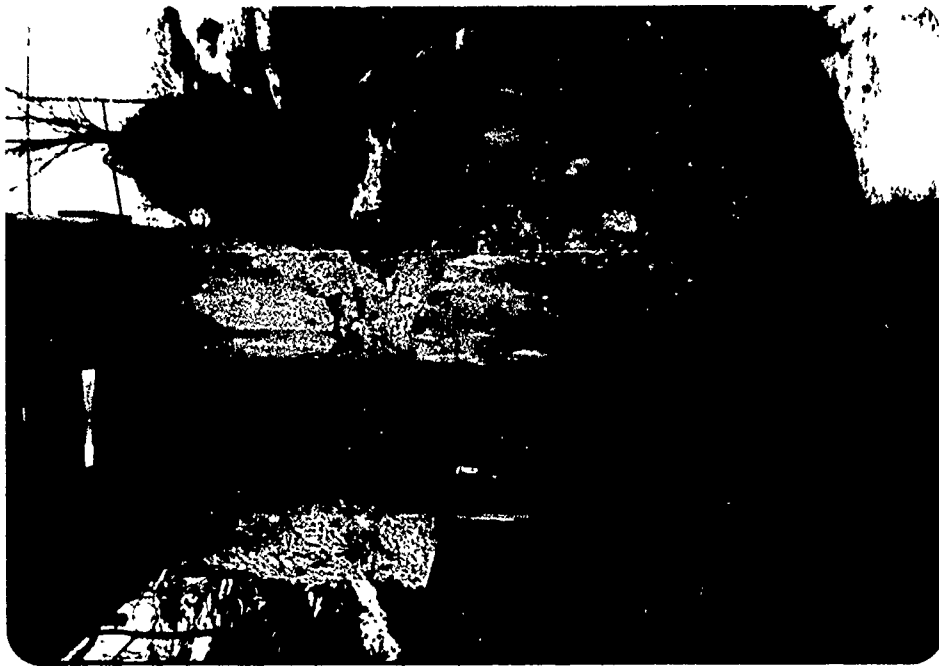
Spillway Flood Gate System  
Looking north  
Photo #16



Spillway Flood Gate  
Note Deteriorated Concrete Slab  
Photo #17



Spillway Flood Gate Supports  
Note Deteriorated Concrete  
Photo #18



Spillway - Deteriorated Concrete of  
South Abutment  
Photo #19

APPENDIX B

ENGINEERING DATA CHECKLIST

**Check List  
Engineering Data  
Design Construction Operation**

Name of Dam Stooping Ings  
I.D. # N.Y. 696

Item	Remarks		
Dam	Plans yes	Details	Typical Sections yes
Spillway(s)	YES		yes
Outlet(s)	yes	yes	yes
Design Reports	NONE		
Design Computations	NONE		
Discharge Rating Curves			
Dam Stability	NONE		
Seepage Studies	NONE		
Subsurface and Materials Investigations	YES		

Item	Remarks
------	---------

Construction History

YES

Surveys, Modifications,  
Post-Construction Engineering  
Studies and Reports

NONE

Accidents or Failure of Dam  
Description, Reports

NONE

Operation and Maintenance Records  
Operation Manual

YES

OPERATION AND MAINTENANCE  
RECORDS ONLY.

Emergency Action Plan (recently updated)  
12/78



APPENDIX C

VISUAL INSPECTION CHECKLIST

## VISUAL INSPECTION CHECKLIST

### 1) Basic Data

#### a. General

Name of Dam SWINGING BRIDGE

I.D. # NY 696

Location: Town FORESTBURG & LUMBERLAND County SULLIVAN

Stream Name MONGAUP RIVER

Tributary of DELAWARE RIVER

Longitude (W), Latitude (N) 74°47'00", 41°34'25"

Hazard Category C

Date(s) of Inspection NOV. 8, 1978, APRIL 20, 1979

Weather Conditions 50's, CLEAR, SUNNY

b. Inspection Personnel ROBERT MCCARTY, MUHAMMAD ISLAM,

KENNETH FIELD, Robert Stuber, Edward Kiene, Joseph Case

c. Persons Contacted KENNETH FIELD, Tel 914, 627-2410

Robert Stuber, Tel 914-786-3310

#### d. History:

Date Constructed APRIL 1929, 2nd generating plant constructed 1938

Owner ORANGE AND ROCKLAND UTILITIES, 1 BLUEHILL PLAZA  
PEARL RIVER, N.Y.

Designer CHARLES H. TENNEY 200 DEVONSHIRE RD, BOSTON., MASS.

Constructed by FRED T. LEY Inc. Central Contractor  
Boston Mass.

### 2) Technical Data

Type of Dam HYDRAULIC FILL

Drainage Area 117.6 SQUARE MILES

Height 135 FEET Length 975 FEET

Upstream Slope 3.5:1 Downstream Slope 2.5:1

2) Technical Data (Cont'd.)

External Drains: on Downstream Face NONE @ Downstream Toe ROCKFILL TOE

Internal Components:

Impervious Core CLAY AND FINE SAND

Drains NONE

Cutoff Type CUTOFF TRENCH FILLED WITH CLAY AND FINE SAND

Grout Curtain NONE

### 3) Embankment

#### a. Crest

(1) Vertical Alignment generally good - 1 minor depression  
near the west end of the embankment - not considered to be  
a problem

(2) Horizontal Alignment good

(3) Surface Cracks none

(4) Miscellaneous \_\_\_\_\_

#### b. Slopes

(1) Undesirable Growth or Debris, Animal Burrows numerous small trees  
on slopes - numerous large trees at abutment contacts and along toe

(2) Sloughing, Subsidence or Depressions Depression on downstream slope  $\approx \frac{1}{2}$   
up from toe, approx. above penstock - dimensions  $\approx 10'$  in diameter &  
 $\approx 2'$  in max depth. no evidence of current movement. Observed a 1 foot depression  
approx 10' x 15' near watch tower on upstream face - probably related to wave action

(3) Slope Protection Both upstream & downstream slopes ripraped.

(4) Surface Cracks or Movement at Toe none evident

(5) Seepage none evident

(6) Condition Around Outlet Structure good condition  
except surge as noted in "3 d & e"

c. Abutments

good condition - some trees along abutment contacts

(1) Erosion at Embankment and Abutment Contact none

(2) Seepage along Contact of Embankment and Abutment none

(3) Seepage at toe or along downstream face see below

d. Downstream Area - below embankment

(1) Subsidence, Depressions, etc. none evident

(2) Seepage, unusual growth as described on next page

(3) Evidence of surface movement beyond embankment toe no evidence

(4) Miscellaneous Surface soil is soft on west side  
of generation station #1

e. Drainage System

1 drain at toe of embankment & north of access road - pipe extends to  
abutment areas estimated flow 10 gpm. 1 drain west of generator #1 below  
access road. described on next page. 1 drain below access road  
approx. 1/2 way between generator #1 & #2 no flow observed.

(1) Condition of relief wells, drains, etc. \_\_\_\_\_

generally good condition

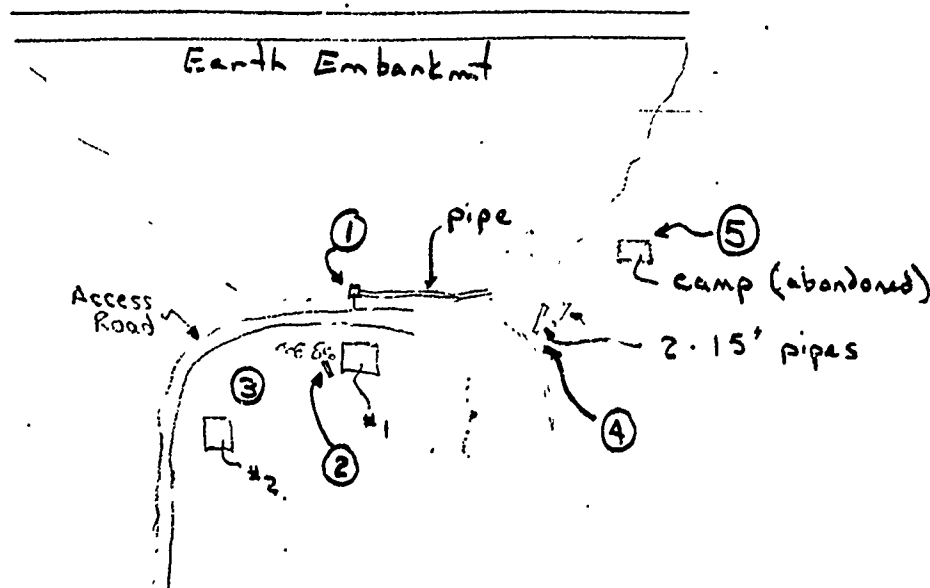
(2) Discharge from Drainage System (Number system corresponds to areas on plan below)

- ① About 10 gpm in front of generator #1 blowing from abutment areas to catch basin - no migration of fines
- ② About 10 gpm thru pipe & 10 gpm bypassing pipe all from the same general area west of generator #1 - origin unknown, no fines
- ③ Drain between generators #1 & #2 no flow observed from 4" pipe
- ④ Seepage in swale on slopes of original grade near east abutment blow ~ 10 gpm - this flow has been occurring as far back as they can remember at approx the same rate - no particle migration - the 2-15" pipes appear to have provided control for run-off but are now plugged w/ soil
- ⑤ A wet area was observed beneath the caretaker's house no flow was observed.



Zones of seepage designated by ①

generators designated  
#1 - 1929  
#2 - 1938



4) Instrumentation

(1) Monumentation/Surveys NONE

reservoir water level gage on intake tower

(2) Observation Wells NONE

(3) Weirs NONE

(4) Piezometers NONE

NONE

(5) Other \_\_\_\_\_

5) Reservoir

a. Slopes OK

b. Sedimentation NONE REPORTED OR OBSERVED

6) Spillway(s) (including tail race channel)

5 electrically operated flood gates each 22.6 feet wide & 6' high ;  
flashboard ~ 122 feet long & 6' high north of flood gates - spillway N.W. of dam

a. General The concrete spillway is founded on bedrock. The tailrace  
channel & downstream channel is bedrock formed or controlled  
concrete deterioration of flood gate supports - (some re-bars  
are exposed) and of spillway slabs

b. Principle Spillway

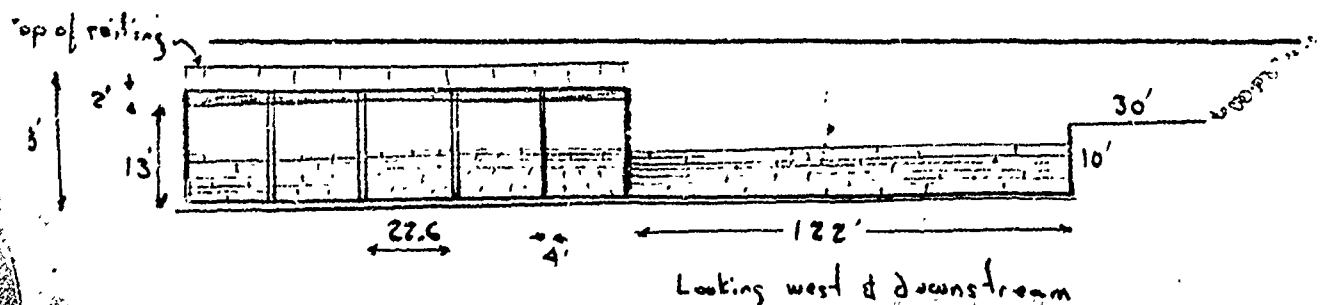
122' wide 6' high collapsible flashboards during  
a 1 foot overtopping (designed)  
some minor leakage of flashboards.

2 intakes for power generation described in section 8

c. Emergency or Auxiliary Spillway 5 Flood gates 22.6' wide  
& 6' high electrically operated from motor units above

d. Condition of Tail race channel Bedrock - some rock debris  
with a few trees directly below the spillway

e. Stability of Channel side/slopes Rock and ripraped channel  
no problems visible - however trees on banks should  
be trimmed out





7) Downstream Channel

natural channel

a. Condition (debris, etc.)

generally in good condition used only during  
flooding. numerous trees

b. Slopes

generally good

c. Approximate number of homes

8 homes - residents of Mongaup  
village

8) Miscellaneous

Power generation system: 2 intakes, one for  
each generator generator #1 (1929) intake tower in reservoir  
Flow from intake tower to the penstock is controlled by an  
electrically operated butterfly valve. The control is in the  
tower. Flow from the reservoir to the 2nd generator is also  
controlled by a butterfly valve (electrically controlled)

and the control is located at the gate house at the north-west corner of the embankment. This penstock is connected to a surge tank. In addition, water supply at entrance to each generator can be shut off by electrically operated valves located in each generator building. Each generator is started by a group of batteries.

9) Structural

- a. Concrete Surfaces cracking and spalling of concrete surfaces  
in flood gate supports & spillway slabs  
concrete intake tower has some calcification
- b. Structural Cracking cracking of intake tower due to  
ice loading metal straps have been used to stiffen  
this area
- c. Movement - Horizontal & Vertical Alignment (Settlement) \_\_\_\_\_  
none observed
- d. Junctions with Abutments or Embankments good condition
- e. Drains - Foundation, Joint, Face \_\_\_\_\_  
see embankment section #3
- f. Water passages, conduits, sluices \_\_\_\_\_  
where observed, good condition & operational
- g. Seepage or Leakage none evident related to concrete  
deterioration

h. Joints - Construction, etc. \_\_\_\_\_

good condition

i. Foundation \_\_\_\_\_

spillway - rock foundation

intake systems - foundation unknown

j. Abutments \_\_\_\_\_

no problems

k. Control Gates \_\_\_\_\_

operational electric motors

for each of 3 flood gates

intake systems electrically operated

l. Approach & Outlet Channels \_\_\_\_\_

bedrock channels

m. Energy Dissipators (plunge pool, etc.) \_\_\_\_\_

none

n. Intake Structures \_\_\_\_\_

generally good condition

o. Stability \_\_\_\_\_

appears good

p. Miscellaneous \_\_\_\_\_

APPENDIX D

HYDROLOGIC/HYDRAULIC

ENGINEERING DATA AND COMPUTATIONS

CHECK LIST FOR DAMS  
HYDROLOGIC AND HYDRAULIC  
ENGINEERING DATA

1

AREA-CAPACITY DATA:

	<u>Elevation</u> (ft.)	<u>Surface Area</u> (acres)	<u>Storage Capacity</u> (acre-ft.)
1) Top of Dam	<u>1080</u>	<u>          </u>	<u>          </u>
2) Design High Water (Max. Design Pool)	<u>1073</u>	<u>          </u>	<u>38,500</u>
3) Auxiliary Spillway Crest	<u>          </u>	<u>          </u>	<u>          </u>
4) Pool Level with Flashboards	<u>1070</u>	<u>          </u>	<u>34,100</u>
5) Service Spillway Crest	<u>1065</u>	<u>1,100</u>	<u>27,400</u>

DISCHARGES

	<u>Volume</u> (cfs)
1) Average Daily	<u>Unknown</u>
2) Spillway @ Maximum High Water	<u>18,600</u>
3) Spillway @ Design High Water	<u>18,600</u>
4) Spillway @ Auxiliary Spillway Crest Elevation	<u>          </u>
5) Low Level Outlet	<u>          </u>
6) Total (of all facilities) @ Maximum High Water	<u>18,600</u>
7) Maximum Known Flood	<u>Unknown</u>

CREST:

ELEVATION: 1080Type: HYDRAULIC FILLWidth: 25 FEET Length: 975 FEETSpillover In a cut section located at northwest of dam. length 122 feet.  
In addition 5 floodgates 22.6 ft wide (each)Location North-west of embankment and not connected to embankment.

SPILLWAY:

PRINCIPAL

EMERGENCY

1065Elevation NONEchannel in a cut section.

Type

122 feet, 5 flood gates each 22.6'

Width

Type of ControlUncontrolled

Controlled:

6 ft. high flashboardsType  
(Flashboards; gate)

Number

Size/Length

Invert Material

Anticipated Length  
of operating service

Chute Length

Height Between Spillway Crest  
& Approach Channel Invert  
(Weir Flow)

## OUTLET STRUCTURES/EMERGENCY DRAWDOWN FACILITIES:

Type: Gate \_\_\_\_\_ Sluice \_\_\_\_\_ Conduit YES Penstock YES  
Shape : INVERTED U SHAPED (UPPER CONDUIT)  
Size: 10 FEET DIAMETER . ALSO 2 - 24" PIPE IN LOWER CONDUIT.  
Elevations: Entrance Invert 959.50  
Exit Invert 957.50  
Tailrace Channel: Elevation 1065.0

## HYDROMETEROLOGICAL GAGES:

Type : NONE  
Location: \_\_\_\_\_  
Records: .  
Date - \_\_\_\_\_  
Max. Reading - \_\_\_\_\_

## FLOOD WATER CONTROL SYSTEM:

Warning System: NONE. EMERGENCY ACTION  
PLAN UPDATED RECENTLY.

## Method of Controlled Releases (mechanisms):

USUALLY THROUGH PENSTOCK . BUTTERFLY VALVE OF PENSTOCK  
IS OPERATED ELECTRICALLY. WATER CAN ALSO BE RELEASED  
THROUGH 2-24" VALVES IN LOWER CONDUIT.

DRAINAGE AREA: 117.6 SQUARE MILES

**DRAINAGE BASIN RUNOFF CHARACTERISTICS:**

Land Use - Type: \_\_\_\_\_

**Terrain - Relief:**

**Surface - Soil:**

**Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions))**

NONE

**Potential Sedimentation problem areas (natural or man-made; present or future)**

NONE

**Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:**

NONE

Dikes - Floodwalls (overflow & non-overflow ) - Low reaches along the Reservoir perimeter:

Location: NONE

**Elevation:** \_\_\_\_\_

**Reservoir:**

Length @ Maximum Pool \_\_\_\_\_ 7 (Miles)

Length of Shoreline (@ Spillway Crest) 17.5 (Miles)



## SWINGING BRIDGE DAM

Drainage area = 118 square miles.

From "Upper Delaware River Basin Hydrologic Flood Routing Model" study, subbasin 50 - pages T8 to F7:

Area of subbasin 50 = 118 square miles.

The entire subbasin 50 is the drainage area of Swinging Bridge Dam.

Modified Standard Project Flood (MSPF) =  $\frac{1}{2}$  Probable Max. Flood (PMF)

$$MSPF = 23,861 \text{ cfs} \approx 23,900 \text{ cfs}$$

$$PMF = 2 \times 23,900 = 47,800 \text{ cfs}$$

## SWINGING BRIDGE

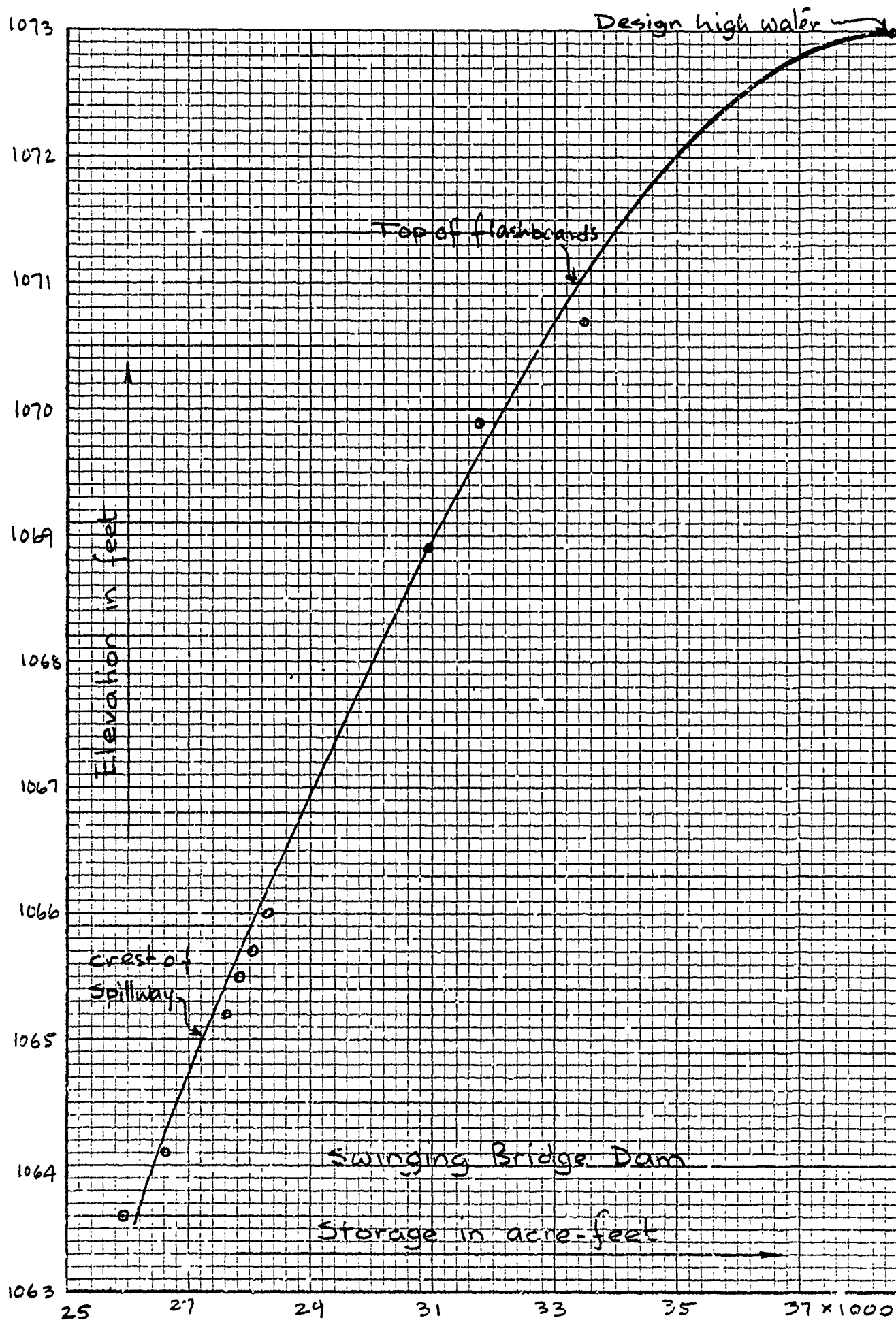
### STORAGE CAPACITY CURVE

Elevation (feet)	Storage (acre-feet)
1063.0	25691
1063.2	25852
1064.1	26634
1065.2	27577
1065.5	27830
1065.7	28014
1066.0	28267
1068.9	30889
1069.9	31809
1070.7	33511
1073.0	38500

Capacity figures given above are based on zero storage at minimum operating pool level El. 1010.0

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# SWINGING BRIDGE Spillway Rating Curve

## 1. Floodgates

## 2. Spillway

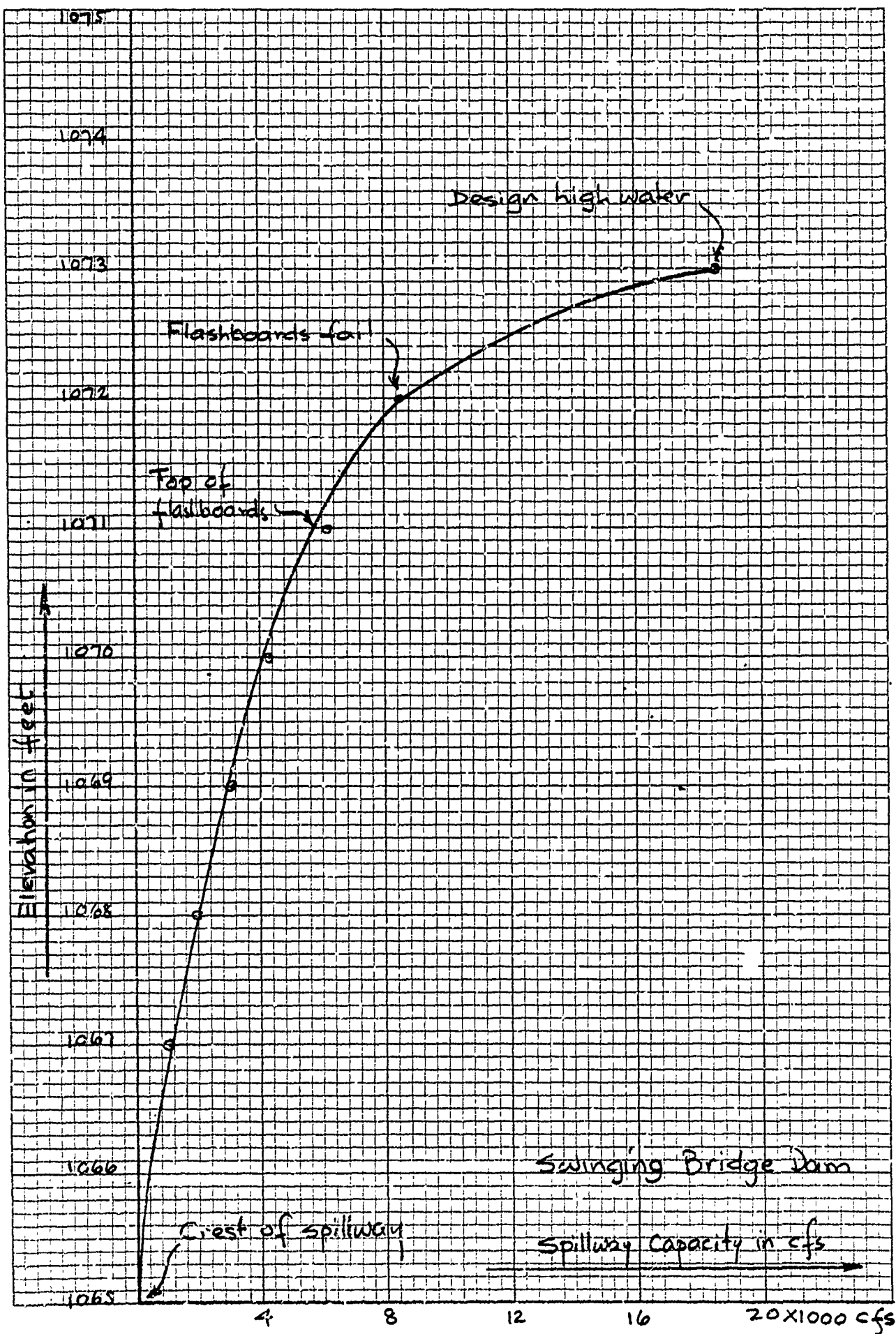
H = Head, L = Length, C = Coefficient of discharge, Q = discharge  
5 floodgates each 22.6' wide. 6' high collapsible flashboards on spillway.

$$Q = CLH^{3/2}$$

Elevation (feet)	H, (feet)	C	L, (feet)	Q, (cfs)	H <sub>2</sub> (feet)	C	L <sub>2</sub> (feet)	Q <sub>2</sub> (cfs)	Q <sub>1</sub> +Q <sub>2</sub> Q cfs	Remarks
1066	1	3.3	113	373	0		122			
1067	2	3.3	113	1055	0		122			
1068	3	3.4	113	1996	0		122			
1069	4	3.4	113	3074	0		122			
1070	5	3.4	113	4295	0		122			
1071	6	3.5	113	5813	1	3.3	122	403	6216	
1072	7	3.5	113	7325	2	3.3	122	1139	8464	Flashboards fail
1073	8	3.5	113	8949	3	3.5	122	9662	18610	

Flashboard collapses with 2' of water over flashboards.

Values of C assumed for simplification.



## OVERTOPPING

$$Q = CLH^{3/2}$$

where

$Q$  = discharge in cfs

$C$  = coefficient of discharge

$L$  = length of floodgate & spillway

$H$  = head

For  $\frac{1}{2}$  PMF = SPF

$$Q = 23900 \text{ cfs}, C = 3.5, L = 235 \text{ ft.}, H = ?$$

$$23900 = 3.5 \times 235 \times H^{3/2}$$

$$H = 9.5 \text{ feet.}$$

$$\text{Elevation at } H = 9.5' \text{ is } 1065.0 + 9.5 = 1074.5 \text{ ft.}$$

For PMF

$$Q = 47800 \text{ cfs}, C = 3.5 \text{ ft.}, L = 235 \text{ ft.}, H = ?$$

$$47800 = 3.5 \times 235 \times H^{3/2}$$

$$H = 15 \text{ feet}$$

$$\text{Elevation at } H = 15 \text{ ft is } 1065.0 + 15 = 1080 \text{ ft.}$$

Top of dam ↙

LIST OF REFERENCES

APPENDIX E

## APPENDIX E

### REFERENCES

- 1) U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, May 1961.
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- 5) W.D. Thornbury, Principles of Geomorphology, John Wiley and Sons, 1969.
- 6) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.
- 7) Cornell University Agriculture Experiment Station (compiled by M.G. Cline and R.L. Marshall), General Soil Map of New York State and Soils of New York Landscapes, Information Bulletin 119, 1977.

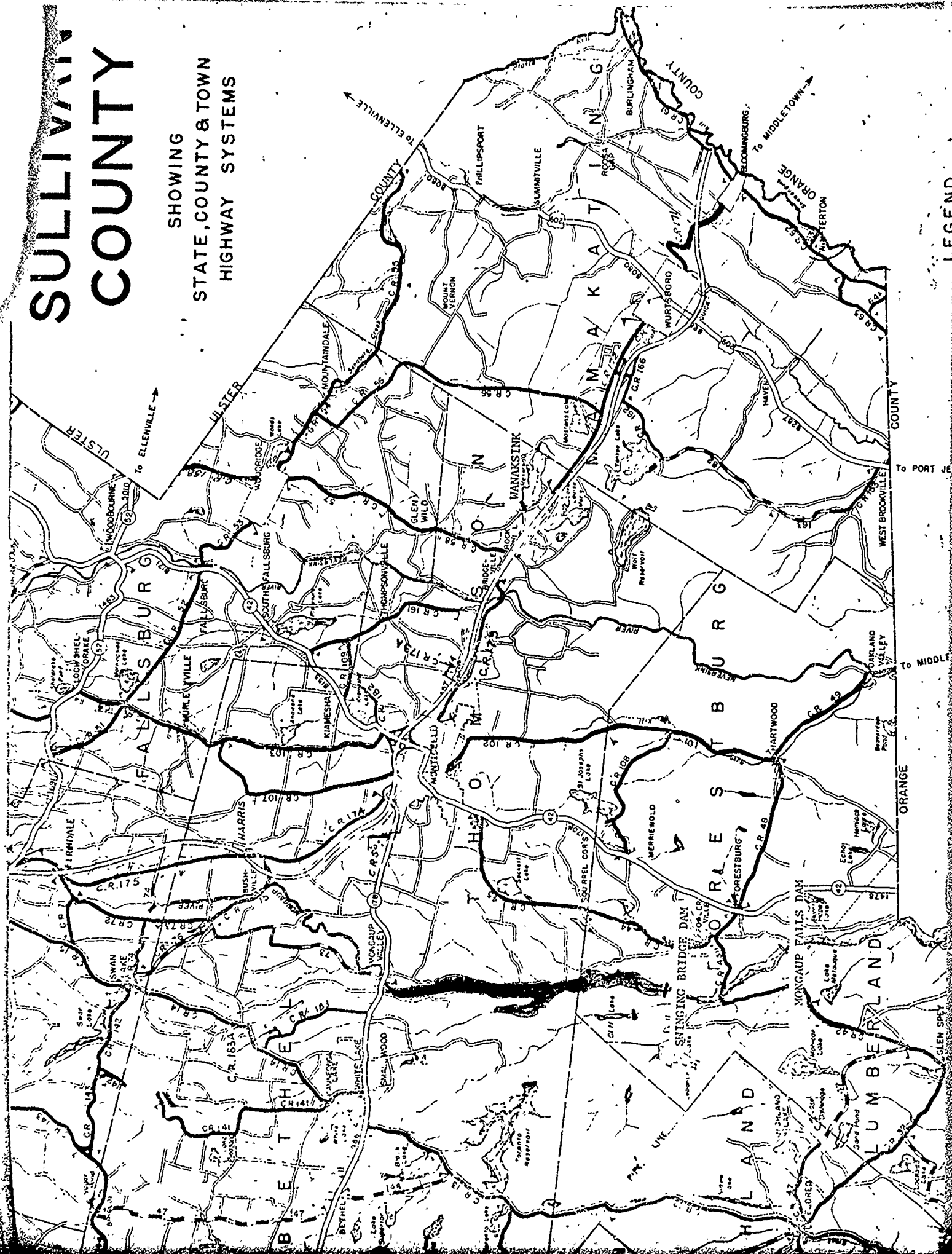


APPENDIX F

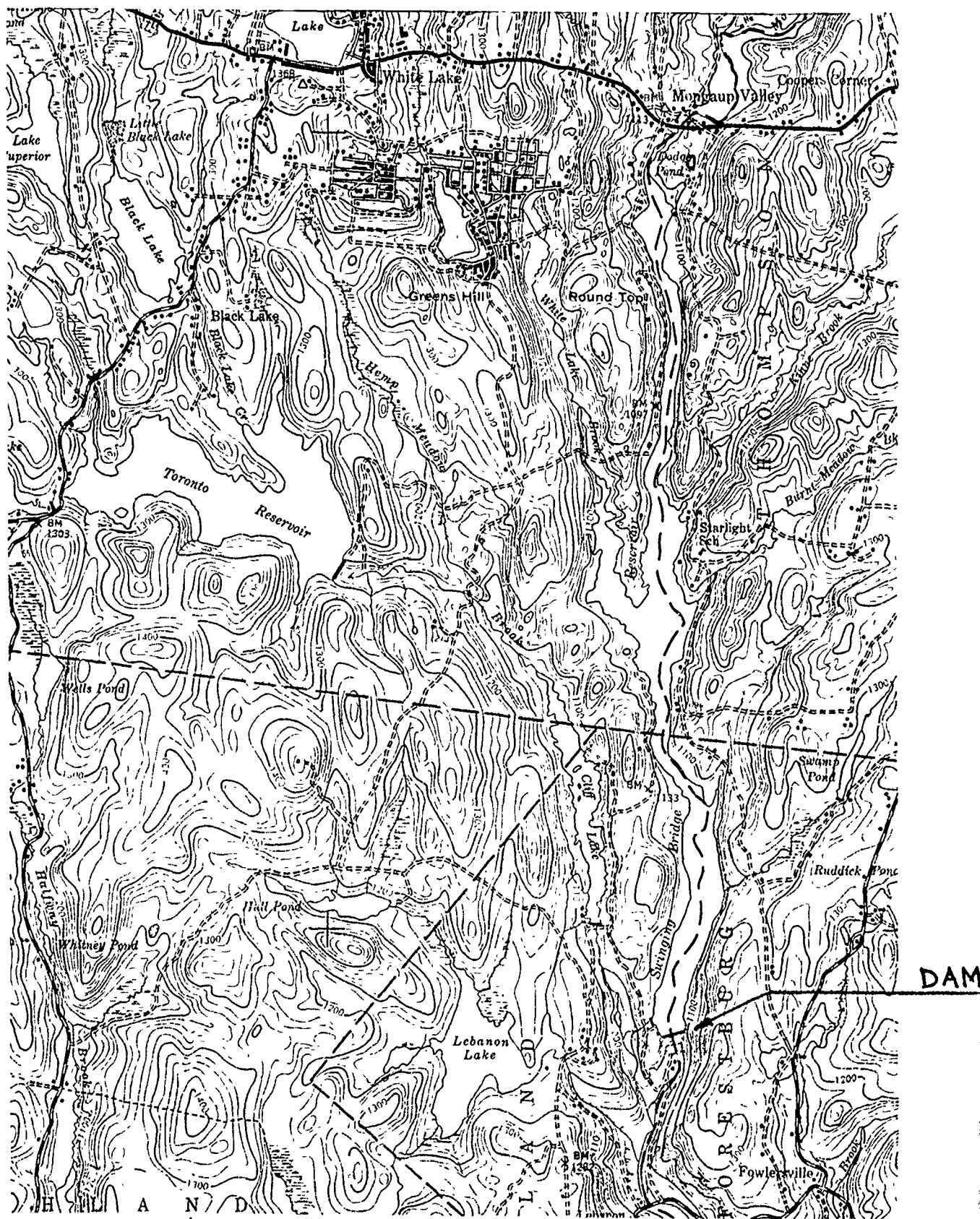
DRAWINGS

# SULLIVAN COUNTY

SHOWING  
STATE, COUNTY & TOWN  
HIGHWAY SYSTEMS



LEGEND



TOPOGRAPHIC MAP

*A. C. Huber*  
**ORANGE AND ROCKLAND UTILITIES, INC.**

one blue hill plaza, pearl river, new york, 10965 914-352-6000

writer's direct dial number 914-627-2420

December 7, 1979

Mr. James D. Hebson, Regional Engineer  
New York Regional Office  
Federal Energy Regulatory Commission  
26 Federal Plaza  
New York, New York 10007

Subject: Emergency Action Plan in the  
Event of Dam Failure at  
Project Nos. 2578, 2592 and 2605

Dear Mr. Hebson:

In accordance with your letter dated October 16, 1978, enclosed are three (3) copies of our revised "Monitoring and Emergency Action Plan, Mongaup River Hydroelectric Facilities." The plan provides a detailed procedure for notification of the proper authorities in the event of an emergency, including a list of telephone numbers of persons to be contacted. A contingency plan for alternate means of communication as well as documentation of correspondence with the New York State Police are also attached.

The Company Duty Officer changes each week and a copy of the Duty Officer schedule is provided to the System Operator's office. By copy of this letter the revised Emergency Action Plan is being transmitted to the Superintendent-Hydro Maintenance for immediate posting in his office. All subsequent revisions shall be likewise forwarded to him.

The revised plan includes a list of parties to be notified in the event of an emergency with the State Police having the primary responsibility and authority to effect any orderly evacuation of the areas of potential flooding. Since Orange and Rockland Utilities is the only operator of water-related facilities along the Mongaup River subject to potential flooding in the event of dam failure, the notification of other such operators is not applicable.

The Company's rigid inspection program, which is summarized in the Emergency Action Plan, affords us the opportunity to determine where repairs are required well in advance of the critical stage. Materials necessary to effect such repairs on a

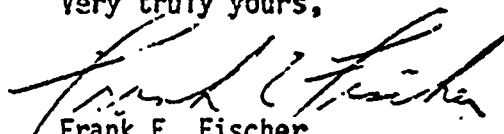
December 7, 1978

timely basis are on hand or are readily available in the area. Therefore, we do not feel the necessity to stockpile additional materials for emergency repairs.

Coordination of flows based on weather forecasts is included in instructions to System Operators. This flow coordination is designed to reduce the risk and amount of potential flooding in the downstream areas.

If we can be of further assistance to you regarding this matter, please do not hesitate to contact us.

Very truly yours,



Frank E. Fischer  
Vice President

BZBjr/ct  
Atts.

cc: B. Muthig, Capt. (NYS Police)

bcc: T. A. Griffin, Jr.  
K. B. Field  
B. Z. Baxter, Jr.  
F. J. Kiernan (4 copies for distribution)  
J. F. Kragh  
W. H. Smith  
J. O. Trudeau  
K. D. Archer

ORANGE AND ROCKLAND UTILITIES, INC.  
MONITORING AND EMERGENCY ACTION PLAN  
MONGAUP RIVER HYDROELECTRIC FACILITIES

(Revised December 1, 1978)

Inspection Procedures Used To Monitor Condition Of Dams

Swinging Bridge, Mongaup and Rio dams are inspected daily by attendant-operators.

Toronto, Cliff Lake and Lebanon dams are inspected on Monday, Wednesday and Friday of each week by Hydro Maintenance crew members.

Each dam will be inspected once a year by a licensed Civil Engineer.

All dams are inspected every five years by consulting engineers representing the Company Bond Holders.

Other Monitoring Procedures

Pond elevations at Swinging Bridge, Mongaup and Rio are recorded by operators at these plants and relayed to Orange and Rockland System Operators at least every 4 hours during normal working hours and 24 hours per day during times of severe floods. When the new Energy Control Center goes into service in mid-1979, these elevations will be monitored continuously and automatically logged hourly at the System Operator's office in Spring Valley, New York.

Instructions to System Operators and Superintendent-Hydro Maintenance

In case of major floods (over 4 inches of rain in 24 hours or 6 inches in 48 hours), or when the in-flow at Swinging Bridge exceeds 2,000 c.f.s., Superintendent-Hydro Maintenance is instructed to close Toronto reservoir gates (if open) and start opening Swinging Bridge

flood gates at a rate which will hold the Swinging Bridge pond elevation at Elev. 1070 or less.

If the Swinging Bridge pond water elevation rises to Elev. 1071, the top 1.2 feet of flashboards will release over the 125 foot length of boards. When this condition occurs the Superintendent-Hydro Maintenance shall notify the System Operator. The System Operator shall notify the New York State Police that a possible emergency condition is imminent and request that Police stand by, but take no action until further notice. If this release by the top 1.2 feet of flashboards does not cause a drop in the elevation of the Swinging Bridge pond, or if the pond again rises to Elev. 1071, the Superintendent-Hydro Maintenance shall notify the System Operator who will notify the State Police to evacuate the houses in Mongaup Village at the lower end of the Mongaup River. The System Operator shall notify the Company Duty Officer, Manager-Electric Production, and Security Manager of the emergency condition and the action taken. The System Operator shall notify the New York Regional Engineer of the Federal Energy Regulatory Commission or his alternate.

If Swinging Bridge pond level continues to rise to above Elev. 1072, the remaining 5.0 feet of flashboards will be released and the maximum spillway capacity will then be available. The sill of this spillway is at Elev. 1065.

The operation of the entire flashboard system with all gates wide open should control the Swinging Bridge pond level for any anticipated flood. If after the operation of the entire flashboard system the pond level does not drop below Elev. 1071, the Superintendent-Hydro Maintenance shall notify the System Operator who will notify the State Police to evacuate the remaining endangered properties located immediately down-

stream of the Mongaup dam and the Rio recreation area. Notification of the Duty Officer, Manager-Electric Production, Corporate Communications, and Security Manager shall also be accomplished.

In the event, during an emergency condition, the Superintendent-Hydro Maintenance cannot make telephone contact with the System Operator, he shall use the Company two-way radio system. If the System Operator cannot make telephone contact with the State Police, he shall request a messenger with a radio vehicle be immediately dispatched from the Company's Western Division Operations Center in Middletown, New York to go directly to the State Police headquarters, also located in Middletown, to notify them of the emergency condition. The messenger shall remain at police headquarters to maintain direct radio contact between the Superintendent-Hydro Maintenance, System Operator, and the State Police.



# MONGAUP RIVER HYDROELECTRIC FACILITIES

## EMERGENCY ACTION PLAN

### NOTIFICATION LIST

New York State Police

(914) 343-1424

Superintendent-Hydro Maintenance  
Joseph B. Case

Office: (914) 856-2109  
Home: (914) 754-8271

Manager-Electric Production  
Frank J. Kiernan

Office: (914) 352-6000, X-441  
Home: (914) 342-0521

Security Manager  
John F. Kragh

Office: (914) 352-6000, X-558  
Home: (914) 496-4964

Corporate Communications  
John P. Murphy

Office: (914) 627-2473  
Home: (914) 942-0246

Federal Energy Regulatory Commission  
New York Regional Engineer  
James Hebson

Office: (212) 264-3687  
Home: (201) 998-2845

Chief Civil Engineer (Alternate)  
Martin Inwald

Office: (212) 264-3687  
Home: (516) 285-5964

Operations Duty Officer

(See Operations Duty Officer  
Schedule and Guidelines)

In answering this, please use the same subject  
heading as on this letter

Subject Monitoring and Emergency Action Plan

To FILE

From B. Z. Baxter, Jr.

cc: Mr. F. E. Fischer

Mr. J. Kragh

Mr. K. B. Field

July 14, 1978

On July 7, 1978 a meeting was held at the New York State Police Headquarters, Troop F, in Middletown, New York to review our June 30, 1978 submittal of subject plan to the Federal Energy Regulatory Commission. Attendees were J. Kragh (O&R), B. Z. Baxter, Jr. (O&R), B. Muthig, Capt. (NYS Police) and J. McMahon, Lt. (NYS Police).

Since we had forwarded a copy of the plan to the NYS Police prior to the meeting, only a short discussion as to the purpose of the plan and the function of the State Police was required. We advised that they were the only group being asked to coordinate this Emergency Action Plan in the event implementation was necessary and we would forward them a list of residences not controlled by O&R that would be affected in the Mongaup Village area. The State Police felt that since there were few residences involved, notification would not be difficult.

They were informed that any changes in the Emergency Action Plan would be forwarded to them as they occurred.

The meeting was highly productive since we will be able to obtain their cooperation.

BZBjr/ct

*B. Z. Baxter, Jr.*  
B. Z. Baxter, Jr.

914-627-2609

July 17, 1978

Blake Muthig, Captain  
New York State Police  
Troop F  
Middletown, New York 10940

Subject: Monitoring and Emergency Action Plan  
Mongaup River Hydroelectric Facilities

Dear Captain Muthig:

As agreed during our July 7, 1978 meeting, attached is a list of residences in the Mongaup Village area not controlled by Orange and Rockland which could be flooded due to upstream dam failure. We also attach a drawing showing location of the homes with respect to the expected area of flooding.

In the event of any changes in the Emergency Action Plan, you will be promptly notified.

Very truly yours,

BZBjr/ct  
Atts.

*B. Z. Baxter, Jr.*  
B. Z. Baxter, Jr.  
Assistant Vice President

cc: Mr. J. Kragh

bcc: Mr. F. E. Fischer  
Mr. K. B. Field

Mongaup Village Residences

Not Controlled By O&R

Donald A. Gregory 856-8324

Tri State Diesel  
McKerrill's Garage 856-6646

Gilson No Phone Listed

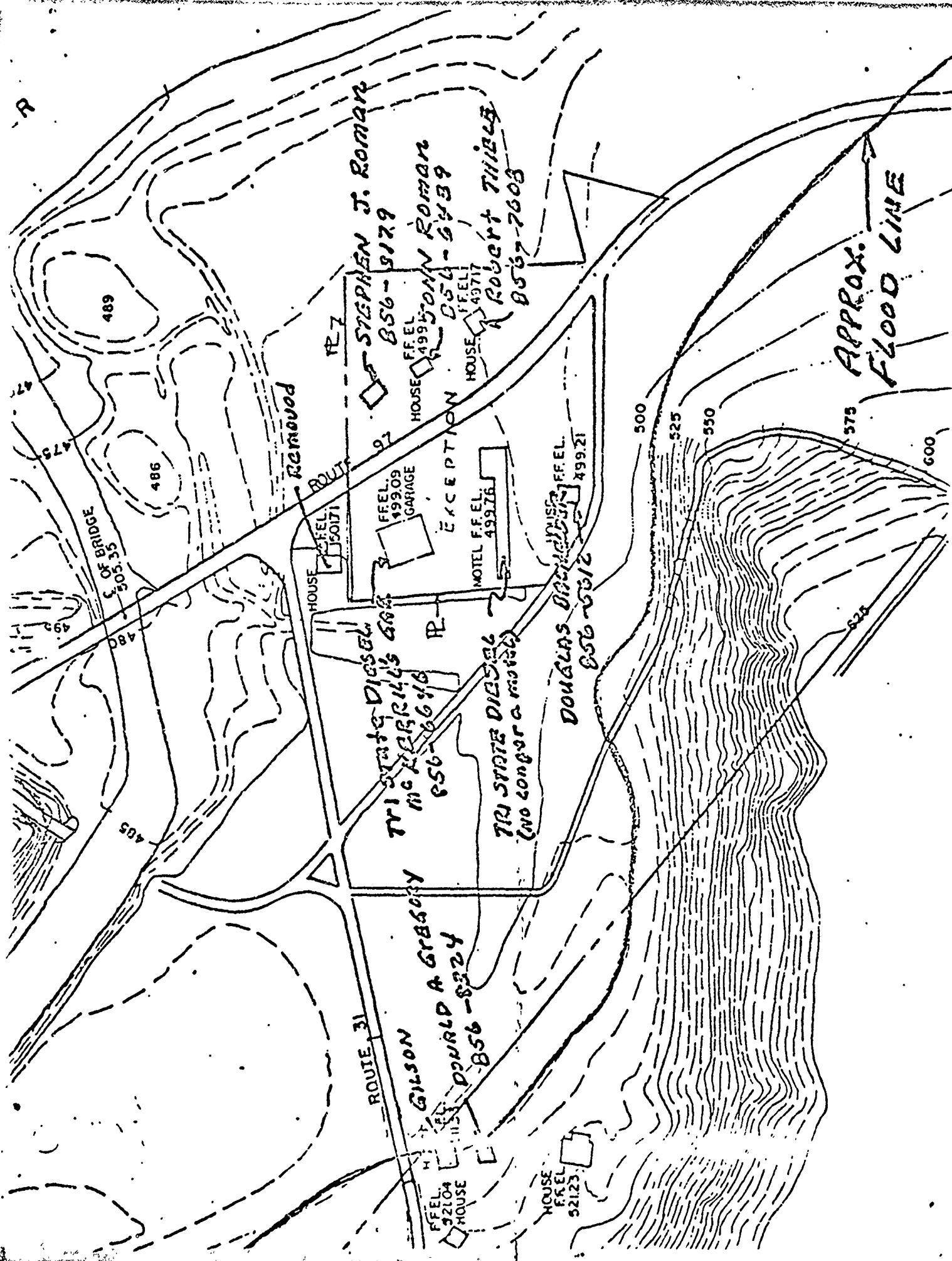
Douglas Bachelder 856-5612

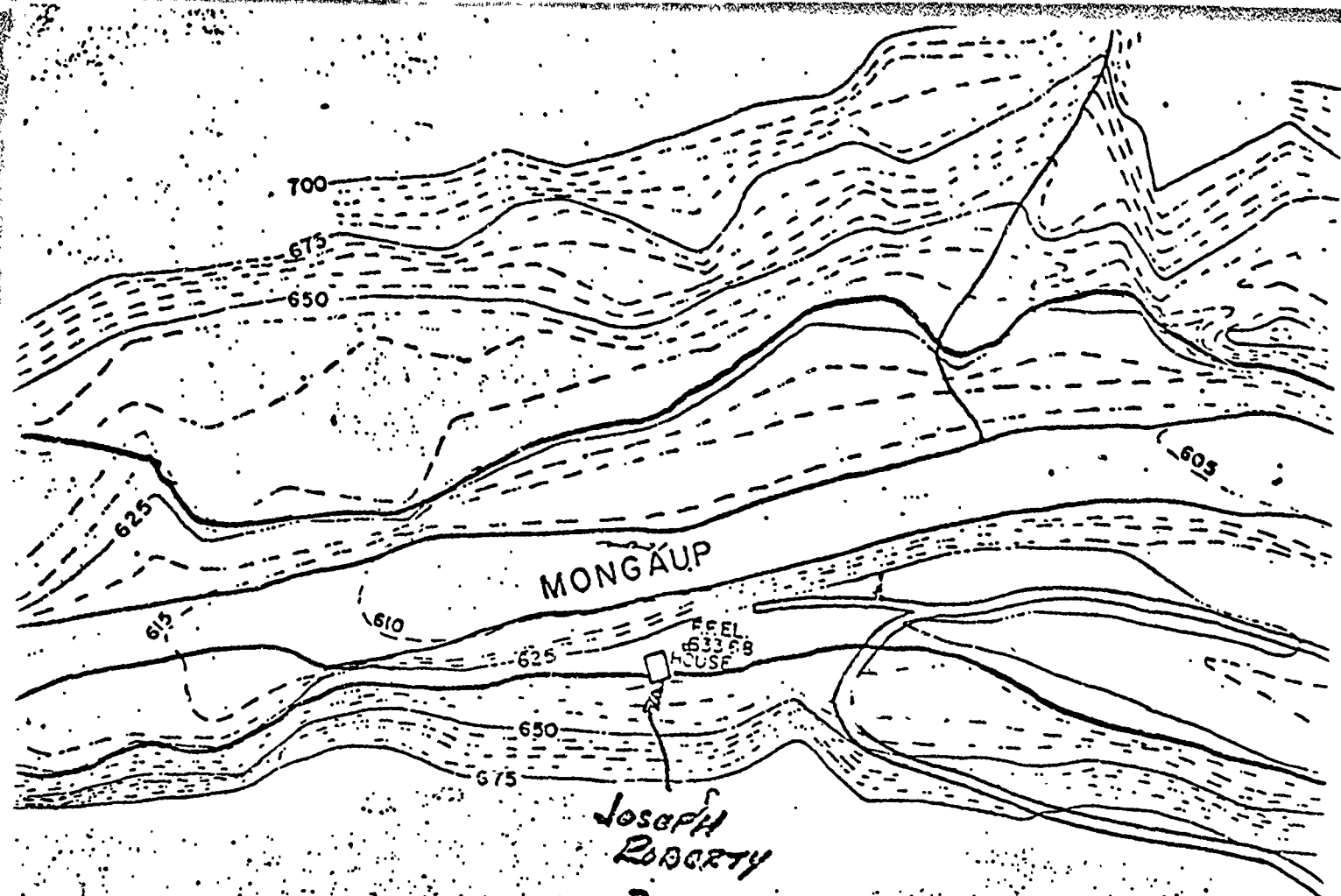
Stephen J. Roman 856-3179

John Roman 856-6439

Robert Thiele 856-7608

Joseph Roberty 856-5685





JOSEPH  
ROBERTY  
2  
856-5685

COMPANY OPERATIONS  
DUTY OFFICER  
GENERAL GUIDELINES

PURPOSE

To provide for the availability of a person of sufficient rank to act in the capacity of Company spokesman and provide high level management direction, if required in the event of an incident or accident within the Company which would have a significant impact in terms of our customers, the general public, regulatory agencies, news media and other interested publics. This is consistent with our Company Policy of providing continuous service to our customers in a safe and efficient manner.

To provide an equitable distribution of Operating Department responsibilities during those periods outside of the normal business hours.

To provide the opportunity for the exposure of the Duty Officer to all facets of operations, thereby developing understanding, appreciation and flexibility of personnel within the Company.

GENERAL GUIDELINES

1. Copies of the Duty Officer Schedule for Company operations will be made available to the Service Operator Supervisor and Service Operators to facilitate contacting the appropriate person when an incident or accident occurs which may have a significant impact on the Company.
2. Persons scheduled for duty may change with other parties on the Duty Officer Schedule and will be obligated to inform the Service Operator Supervisor of such change.
3. The availability of the Duty Officer will be required during the entire week that the person is scheduled. Availability is not construed to mean that the person must stay at home by the telephone. However, it does mean that the person may be contacted in a timely fashion.
4. The person designated as Duty Officer for the week will act as the Company spokesman concerning any incident or accident that occurs during that week, until such time as another appropriate individual becomes available to act as the Company spokesman.
5. The availability of a Duty Officer will not supersede or change established procedures for emergency notification of functionally responsible Officers or other personnel.

GENERAL GUIDELINES - (Continued)

6. The Duty Officer shall act as the liaison authority across all departments, such as Transportation, Stores, etc. during the period outside of normal business hours. Problems which may develop after the standard Operating Procedures have been exhausted at lower levels of management, concerning the coordination of support services will be resolved by the Duty Officer.
7. Included with the Duty Officer Schedule are Emergency Procedures that are to be followed either by the Standby Duty Supervisor and/or persons within the operating departments in compliance with established requirements. It shall be the responsibility of the Duty Officer to ensure that these requirements are accomplished in a timely manner.



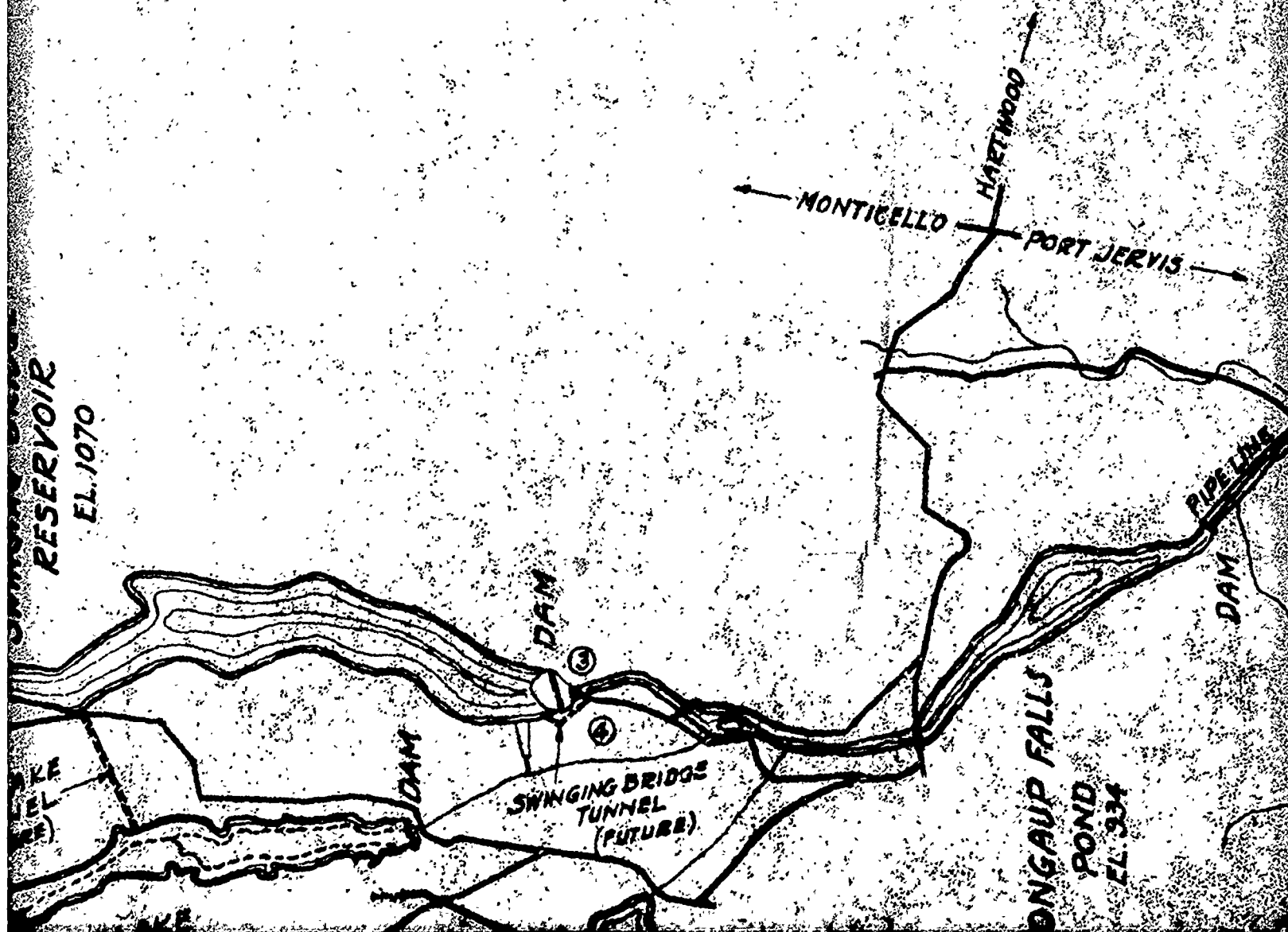
List of Drawings

Swinging Bridge Dam

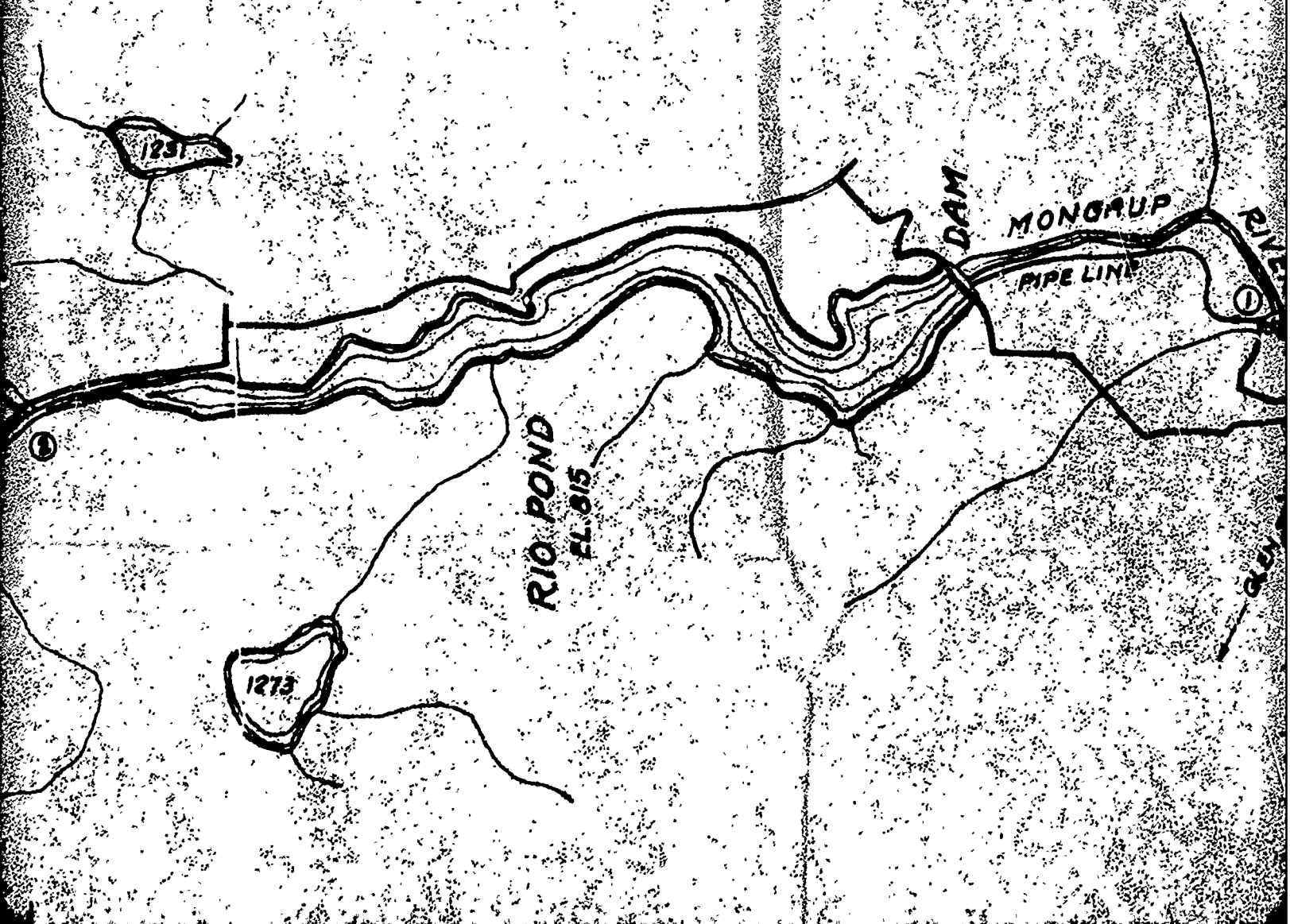
	<u>Drawing Number</u>
Developments on Mongaup River	1300-50
General Plan	-
Borings	KK3-16
Dam	KK3-17
Spillway	KK3-18
Intake	KK3-19
Gate Tower	KK3-21
Conduit	KK3-25
Conduit Outlet	KK3-27
Powerhouse - General Plan (Generator #1)	KK3-28



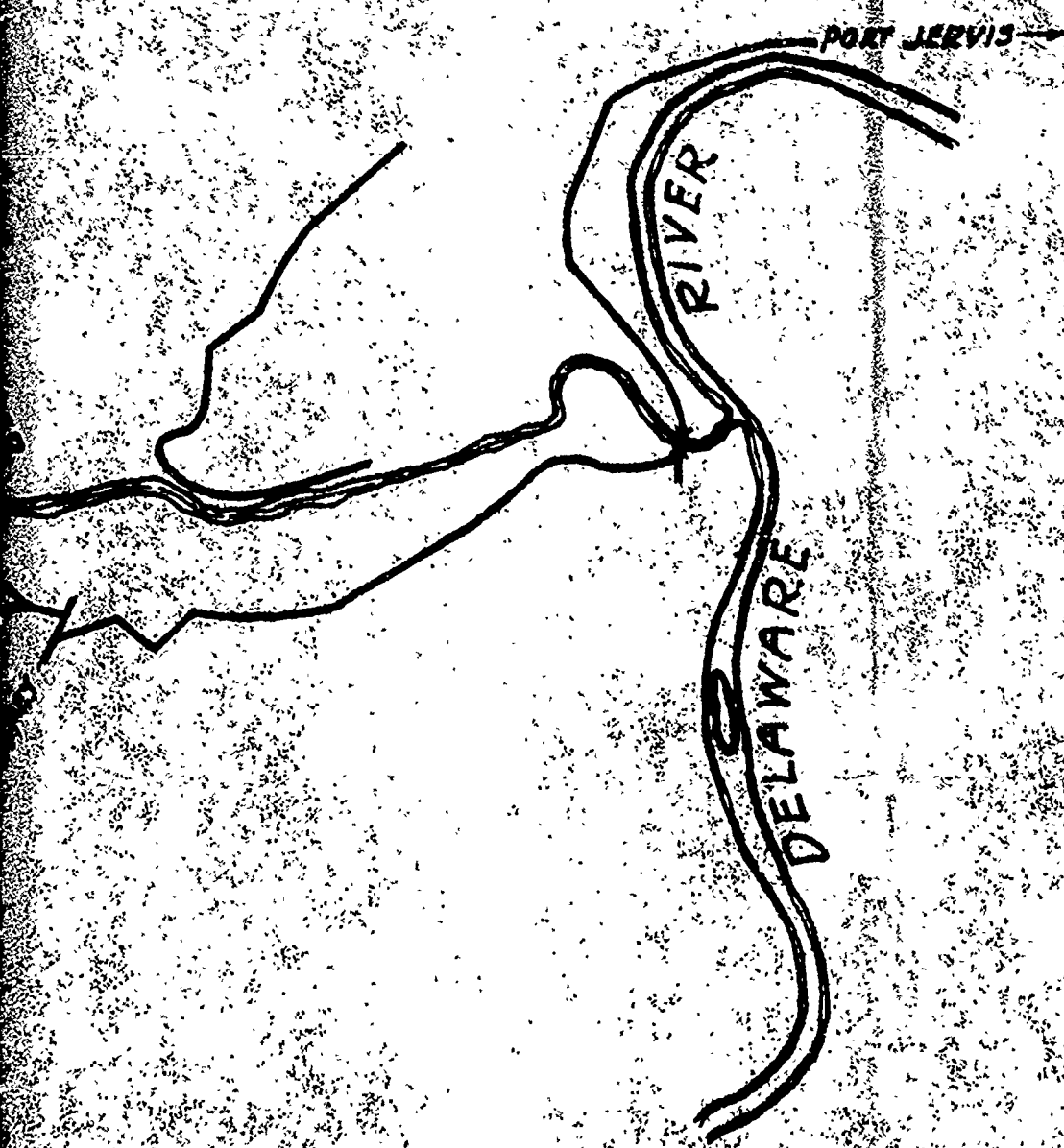
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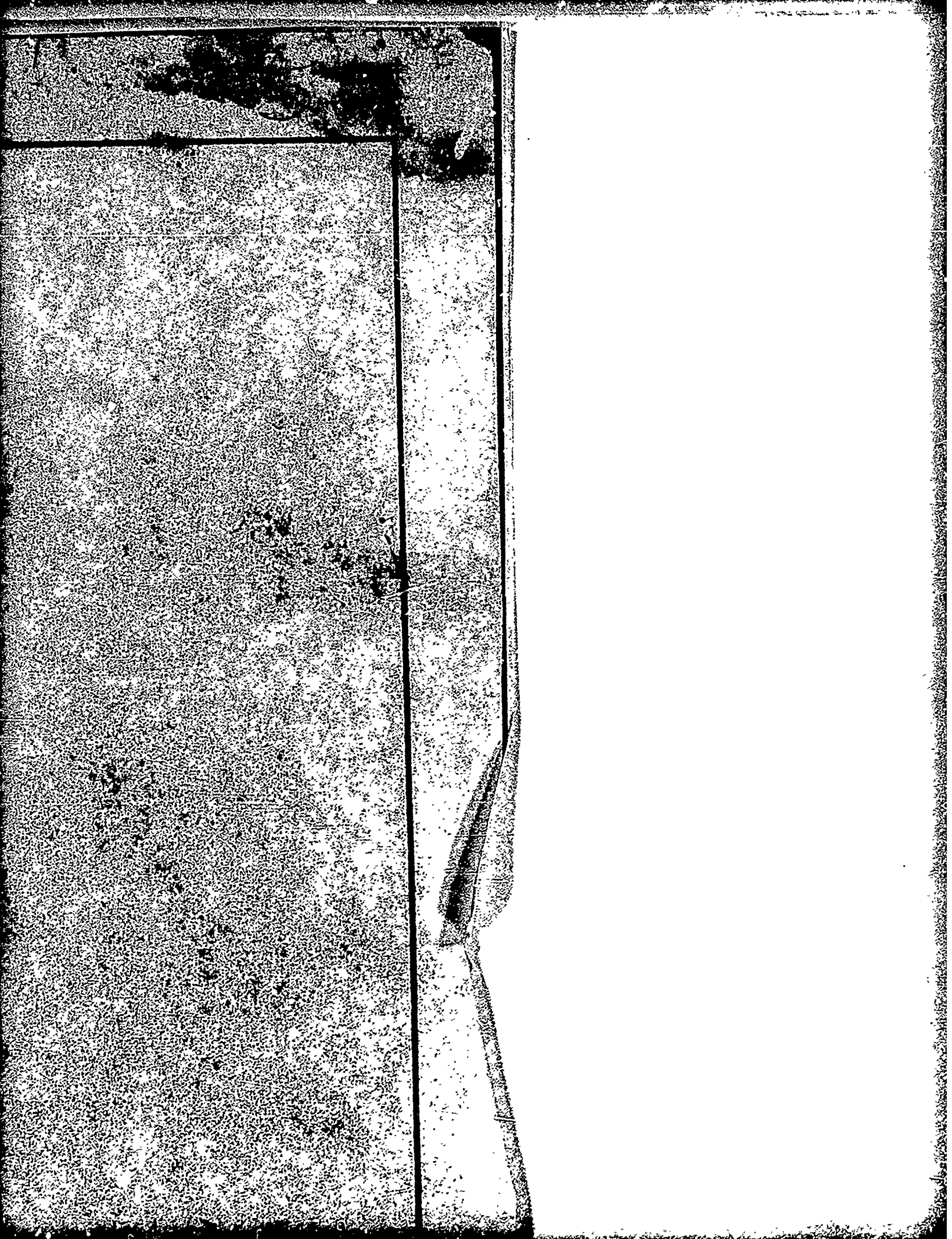
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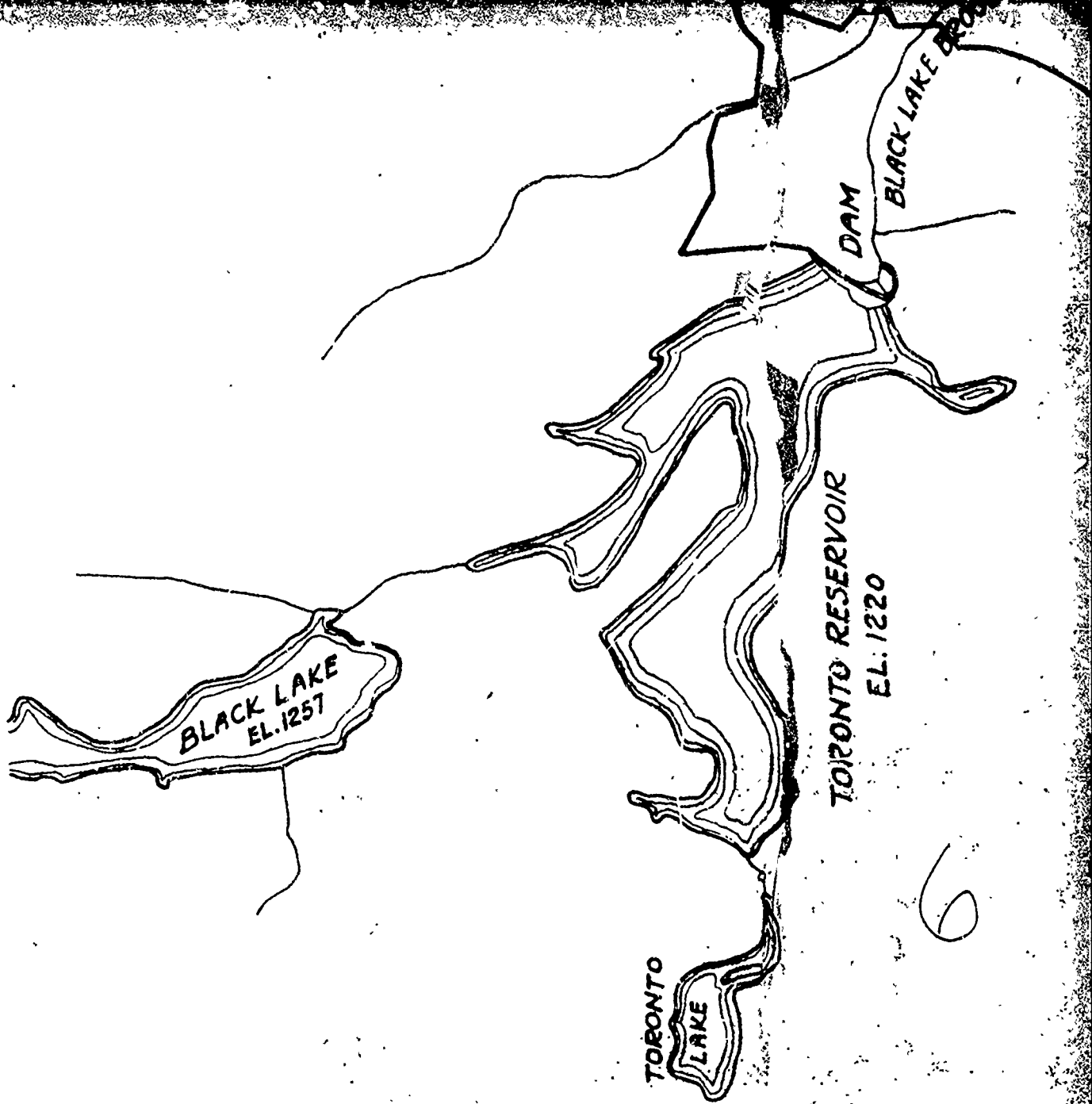


4









1300

1200

1100

1000

900

TORONTO RESERVOIR EL. 1220

DAM

PROFILE ON BLACK

1100

1000

SWINGING BRIDGE RESERVOIR EL. 1070

CLIFF LAKE  
PRESENT EL. 1047  
FUTURE EL. 1070

LEBANON LAKE  
CHANNEL (FUTURE)

LEBANON LAKE  
EL. 1136

CLIFF LAKE EL. 1070

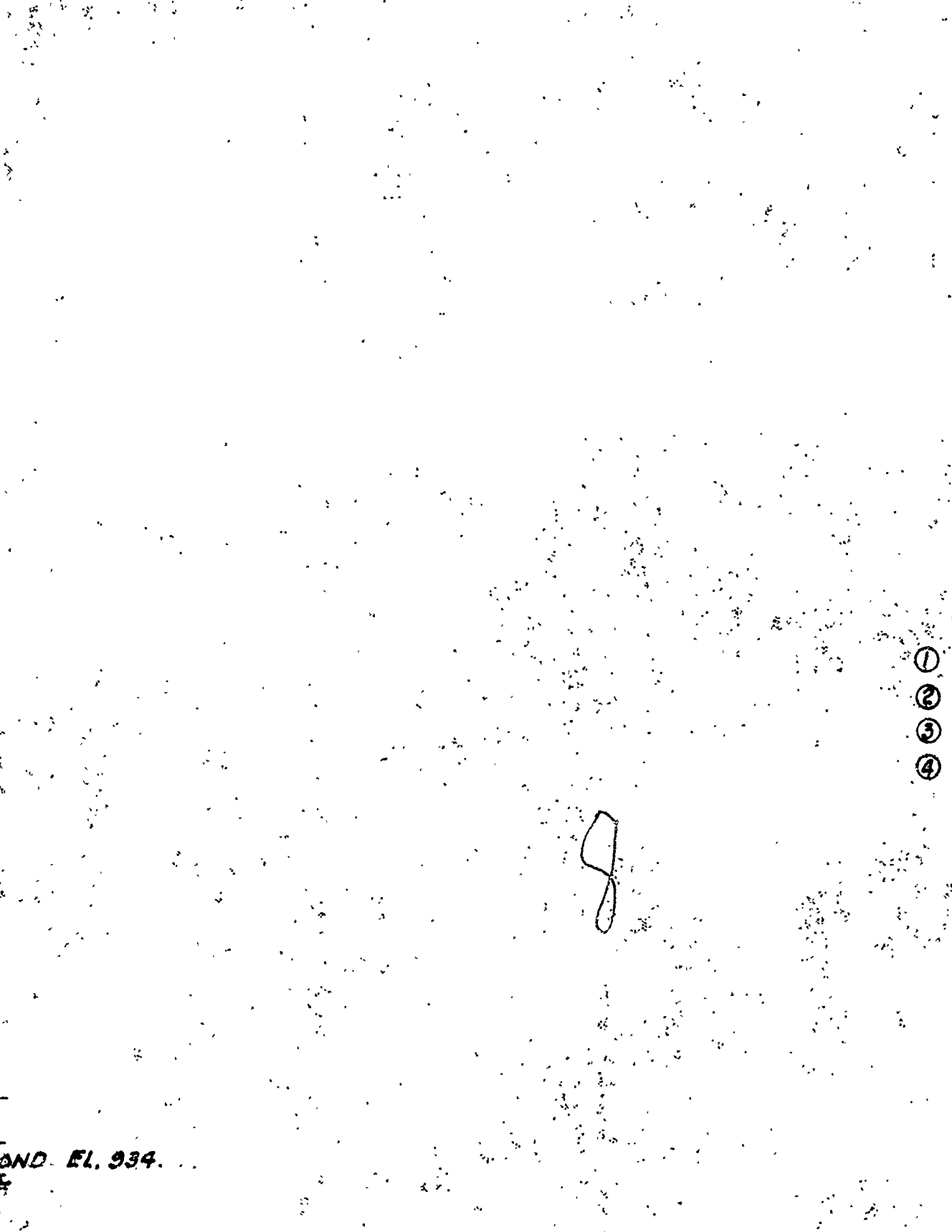
DAM

MONGAUP R.

LAKE BROOK

HOUSE  
15.5



- 
- ① RIO PO  
② MONGA  
③ SWING  
④ SWING

FALLS POND EL. 934.

POWERHOUSE - 10,000 K.W.

UP FALLS POWERHOUSE - 4000 K.W.

ING BRIDGE POWERHOUSE NO. 1 - 5000 K.W.

ING BRIDGE POWERHOUSE NO. 2 - 5000 K.W. (FUTURE)

9

10

10

1300

1200

1100

1000

900

TORONTO RESERVOIR EL. 1220

DAM

PROFILE ON BLACK LA

1100

SWINGING BRIDGE RESERVOIR EL. 1070

1000

900

11

CLIFF LAKE EL. 1070.

DAM

MONGAUP FALLS

LAKE BROOK

DAM  
POWERHOUSE  
T.M. EL. 945.5

MONGAUP FALLS POND EL. 934

DAM

800

700

PROFILE ON MONGAUP RIVER

12

FALLS POND EL. 934.

POWERHOUSE  
T.W. EL. 920.

RIO POND - EL. 815

DAM

600

13

POWERHOUSE  
T.W. EL. 630

14

ROCKLAND

DEVELOPMENT  
GEN

CHAS. T. M.  
201 DEVONSHIRE ST.

7-14-38 General Ren

IN CHARGE W. P. G.		
DRAWN	TRACED	CHECKED
R.A.K.		

S

D



ROCKLAND LIGHT & POWER CO.

NYACK-N.Y.

DEVELOPMENTS ON MONGAUP RIVER  
GENERAL PLAN

CHAS. T. MAIN, INC. ENGINEERS

301 DEVONSHIRE ST.

BOSTON, MASS. U.S.A.

REVISIONS

7-14-38	General Revisions

IN CHARGE W.F.U.

DRAWN

TRACED

CHECKED

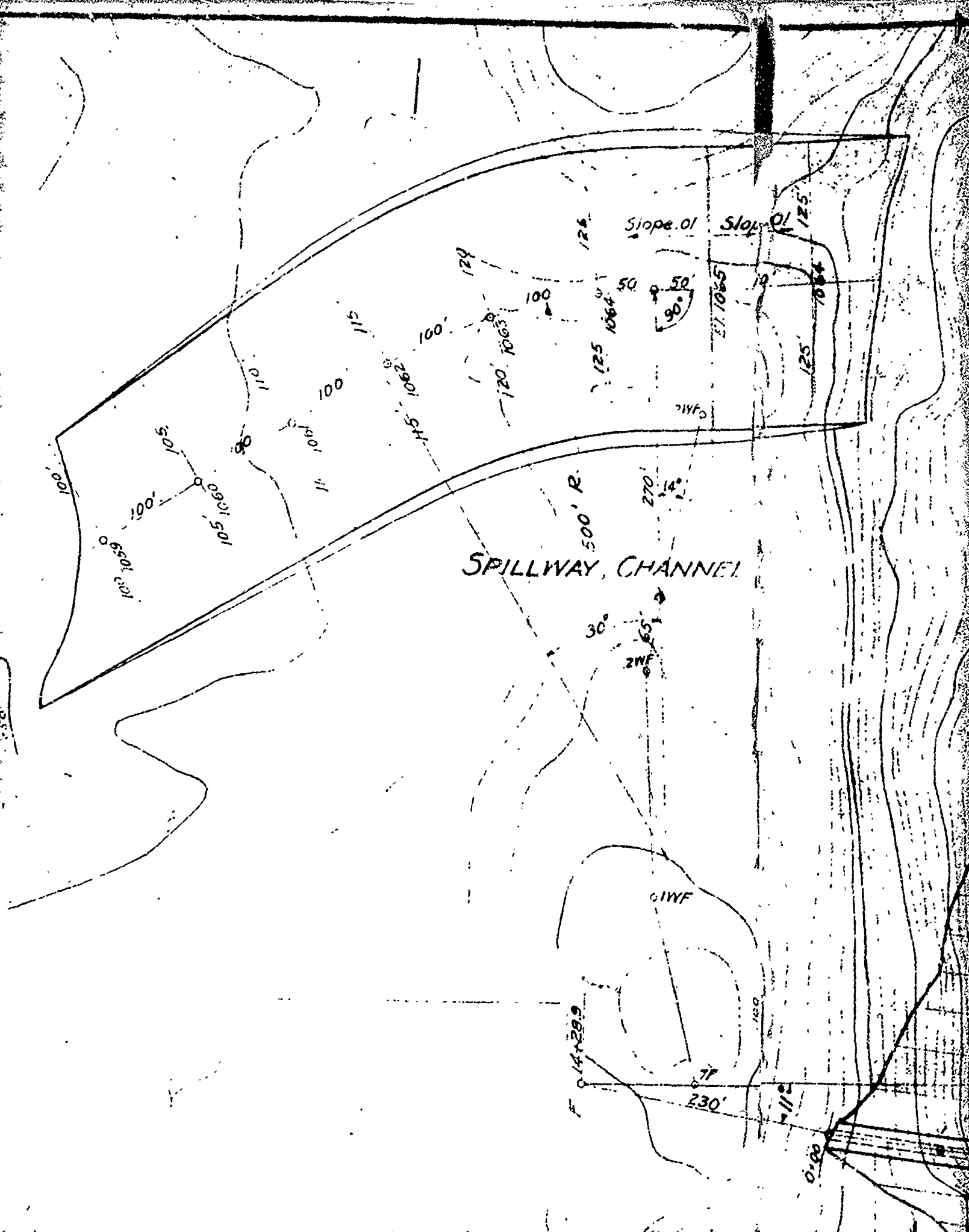
R.A.K.

SCALE 1 in. = 3000 ft.

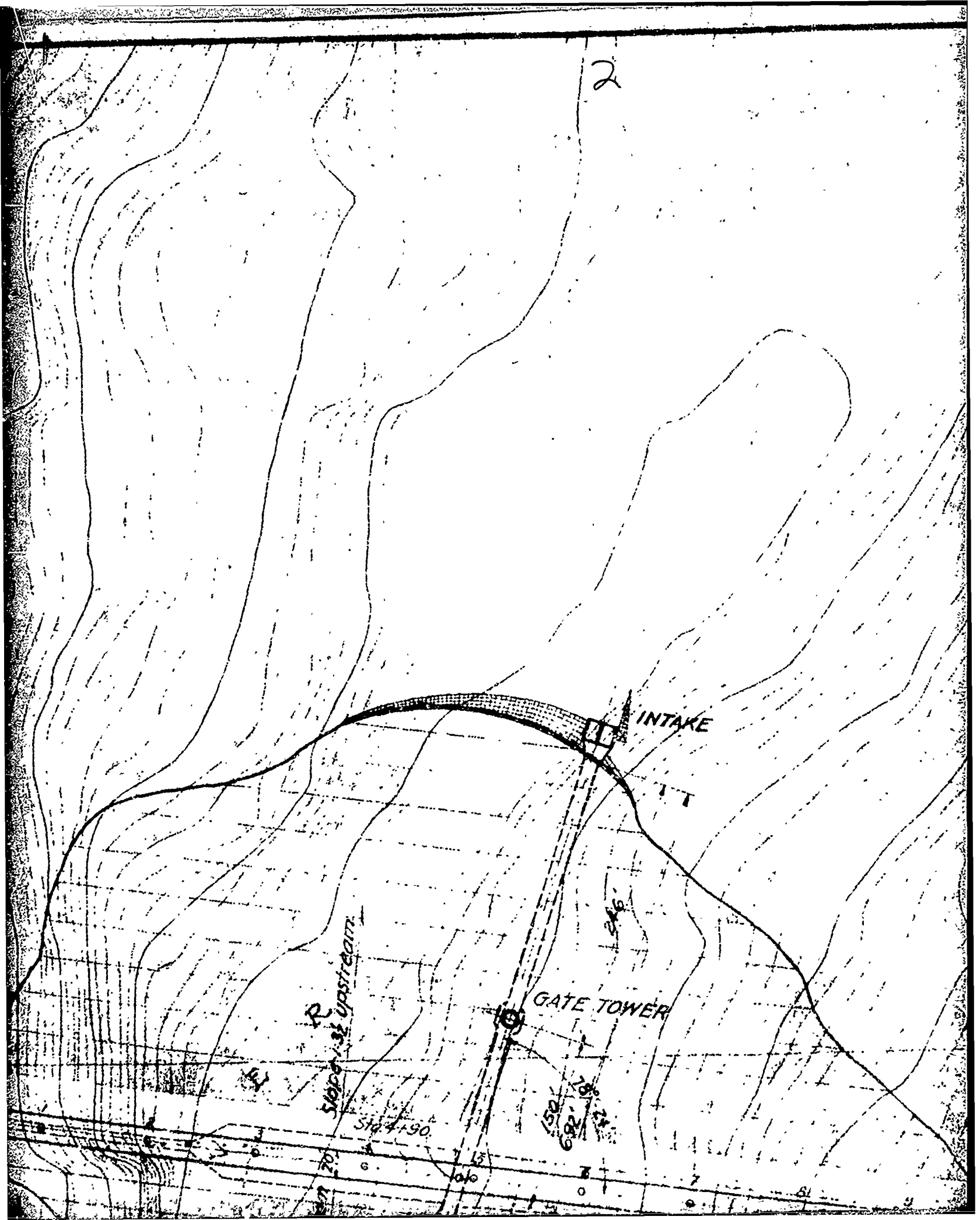
DATE July 7-1938

1300-50

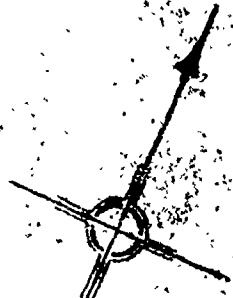
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2



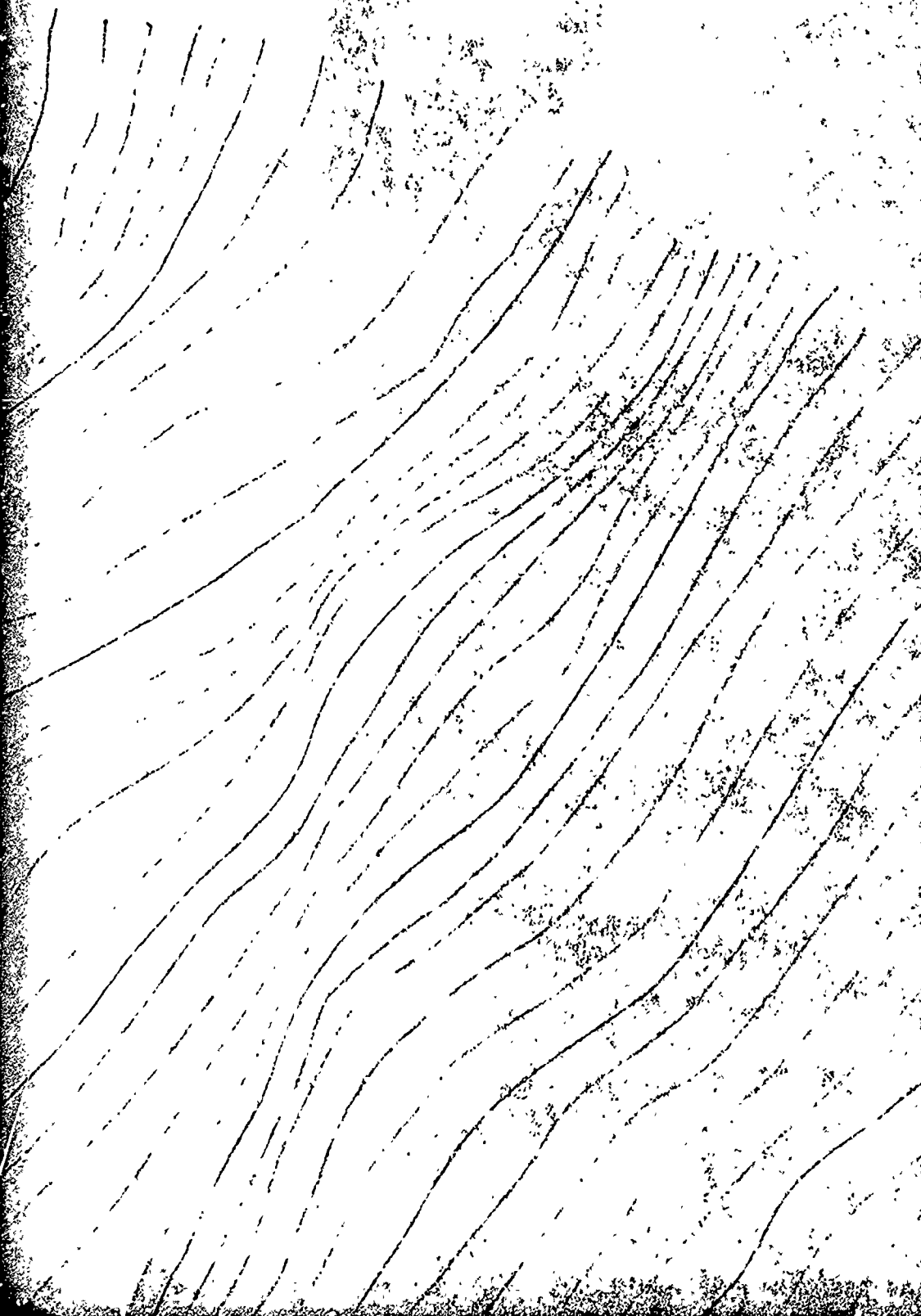
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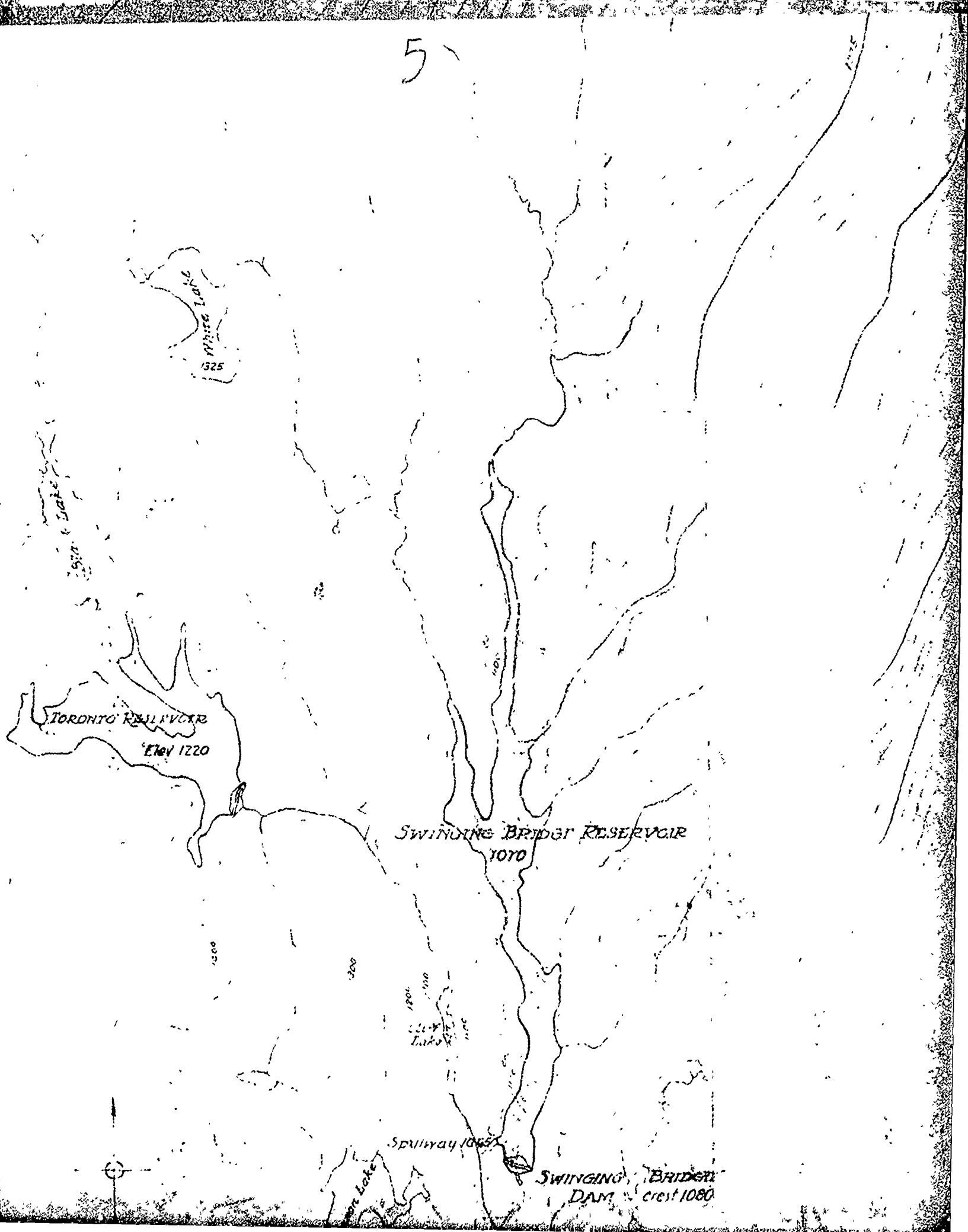
Elev 1070 Water Line Reservoir Full

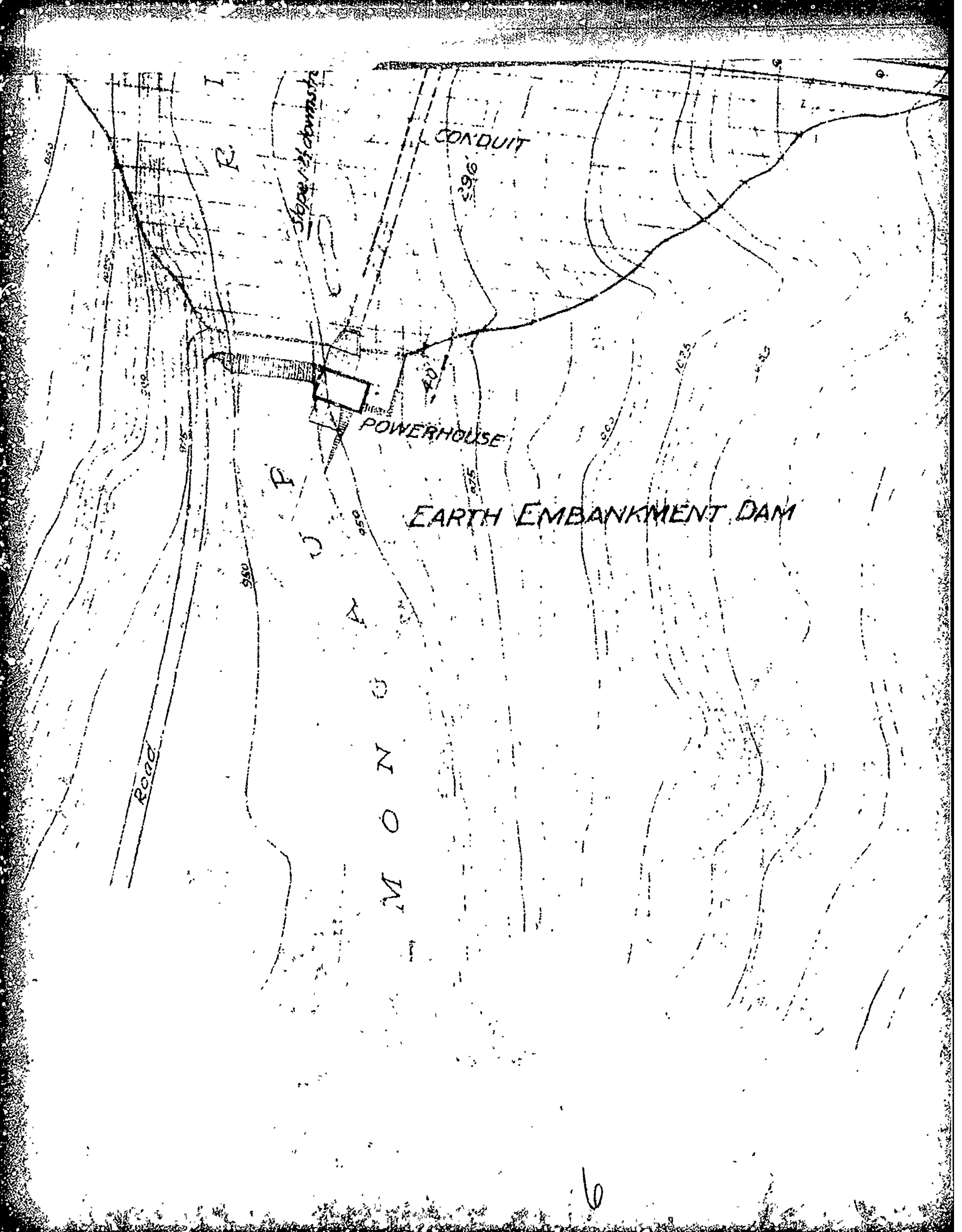
Elev 6000

4



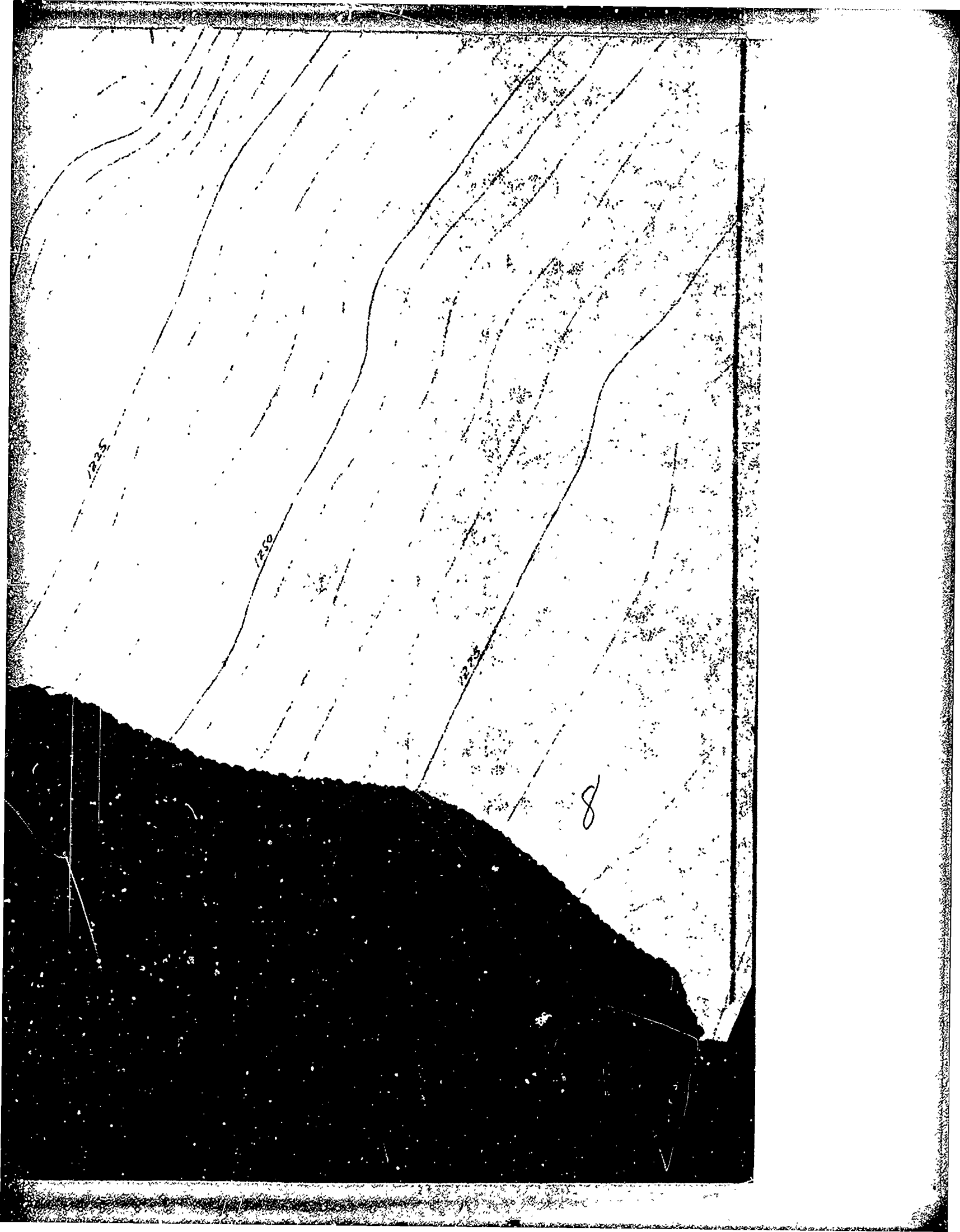
5











Spillway 1065

Lebanon Lake

SWINGING BRIDGE  
DAM crest 1080

VICINITY MAP  
Scale 4" = 1 mile.

Mongour  
Tells

0

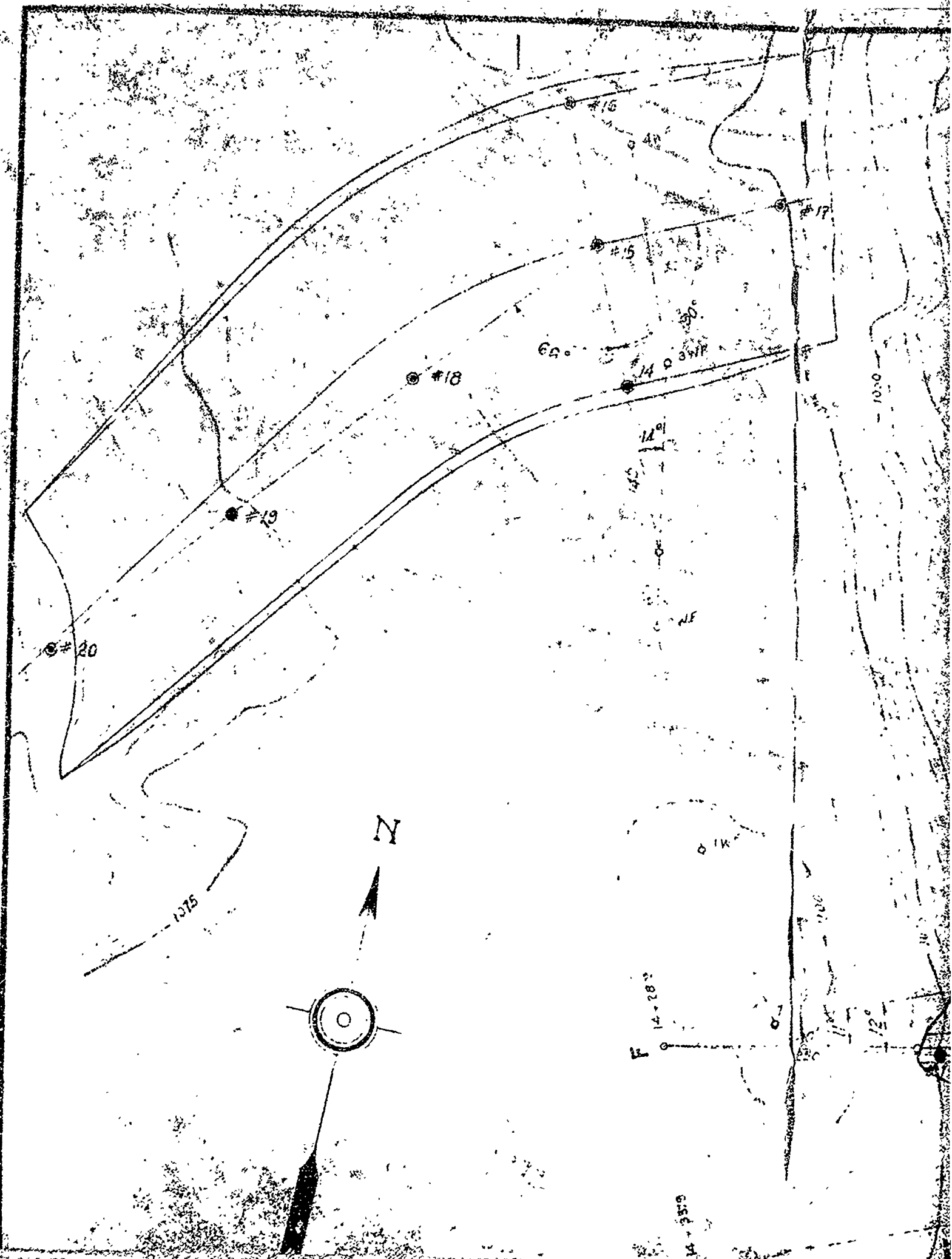
30126.8 N1191 R5

6

10

REFERENCE	DRAWING	TITLE
NUMBER		
KK-3-16		BORINGS
17		DAM
18		SPILLWAY
19		INTAKE
21		GATE TOWER
25		CONDENSER
28		POWER HOUSE

THIS DRAWING IS THE PROPERTY OF CHARTER  
AND IS SUBJECT TO BE TURNED OVER







4

#38

#33

#27

#21

KEY



*Loam and top soil.*



*Sand*



*Sandstone*



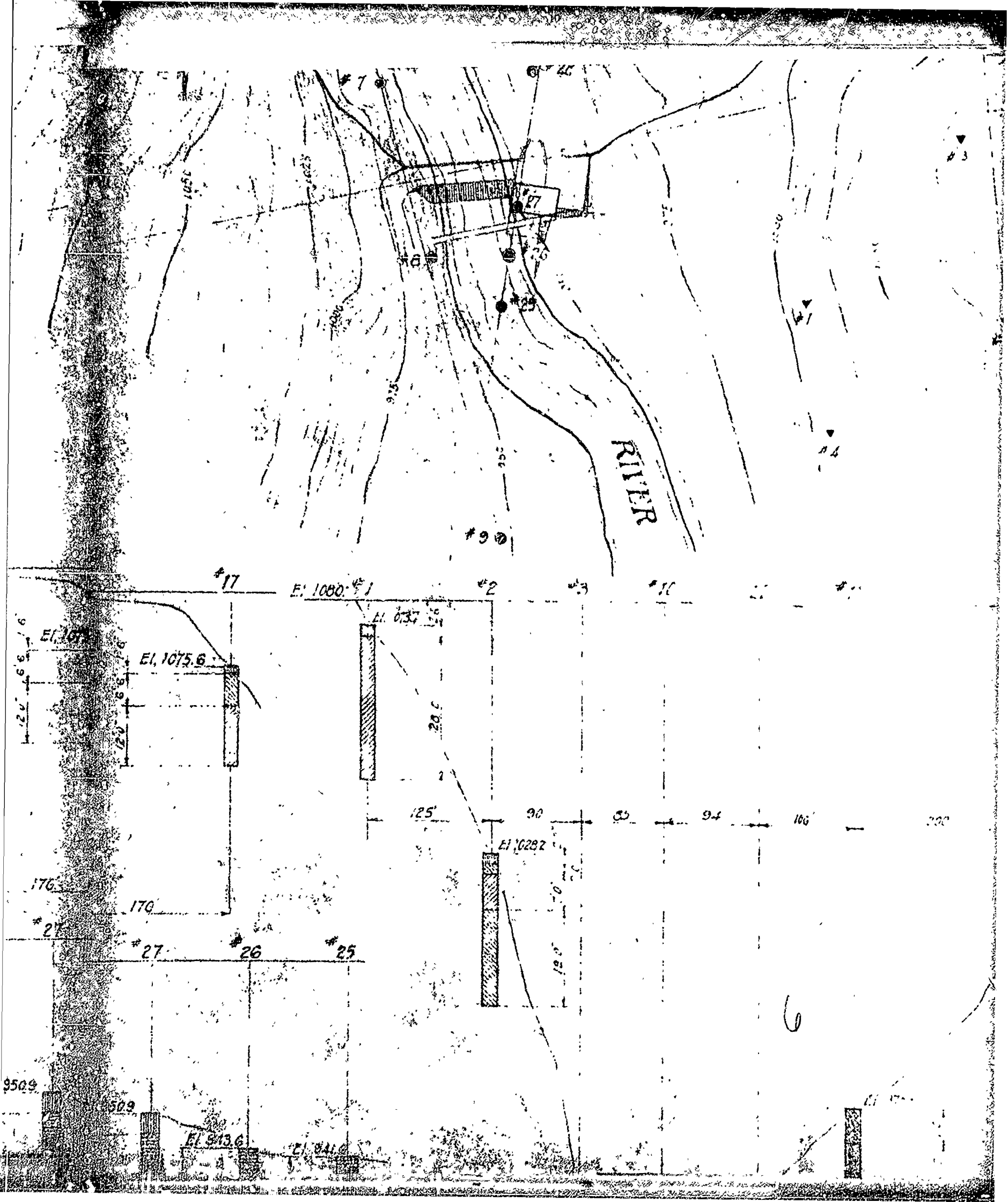
*Sand and clay*

#15

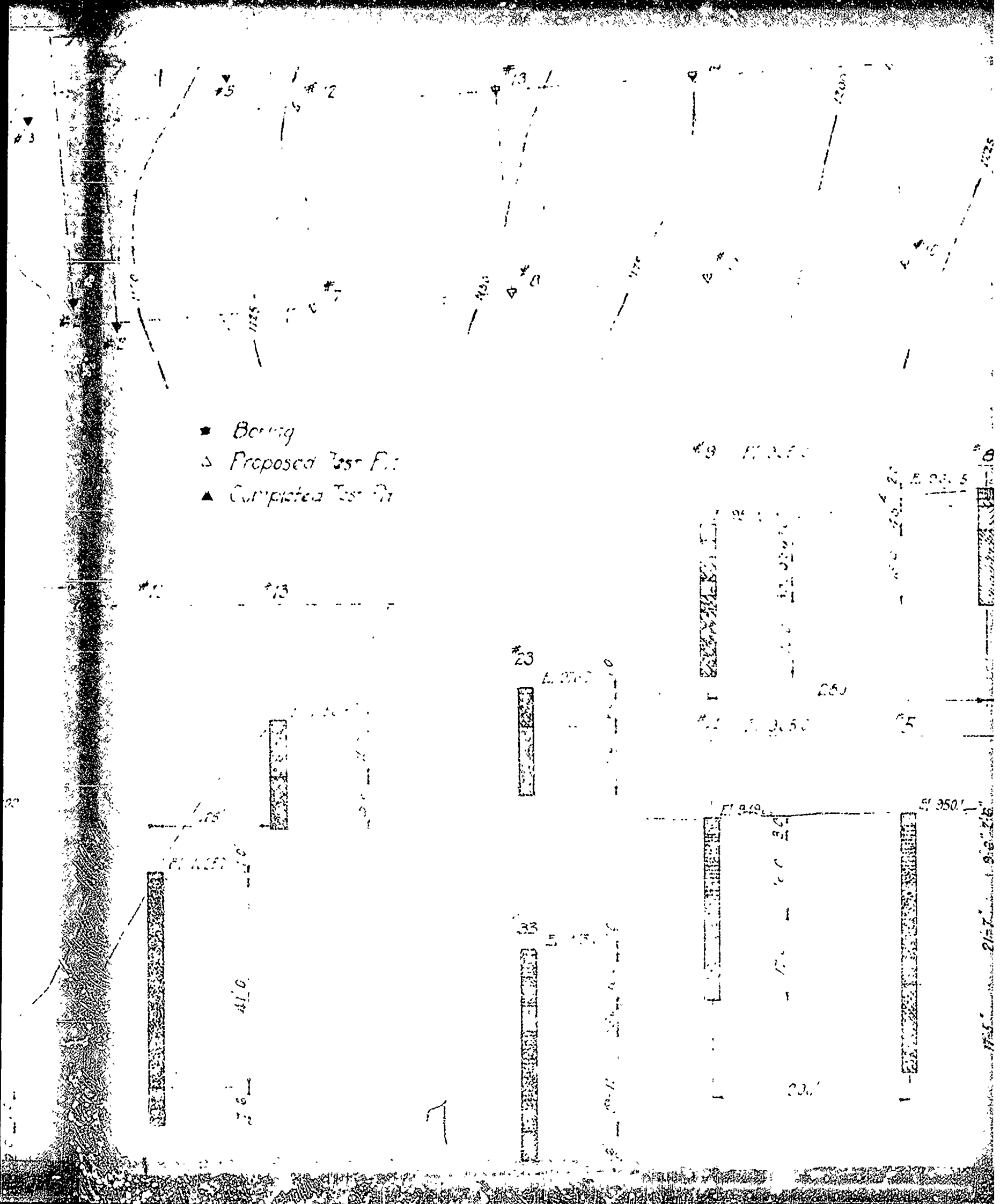
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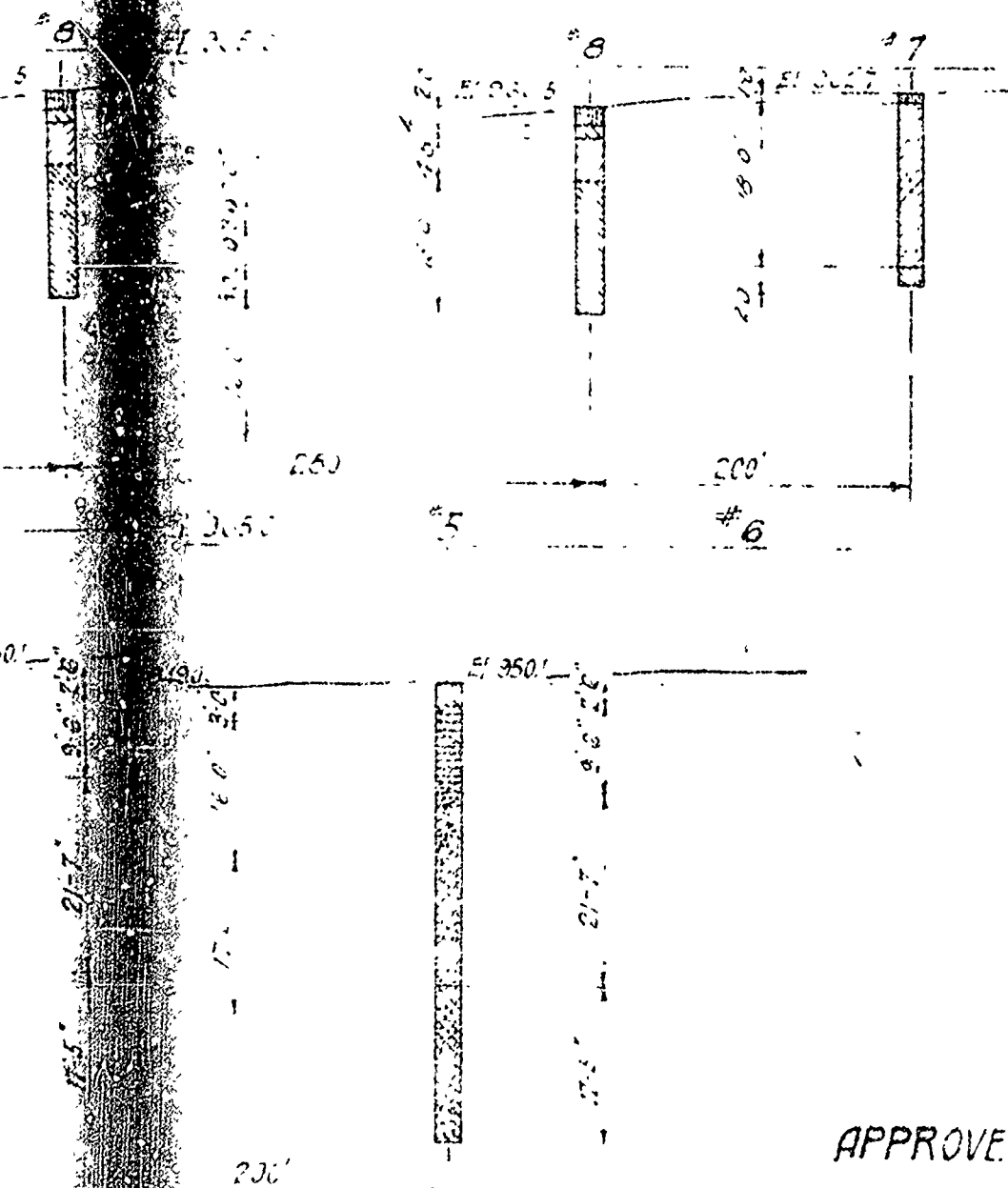
El.



- Boring
- △ Proposed Test Pit
- ▲ Completed Test Pit

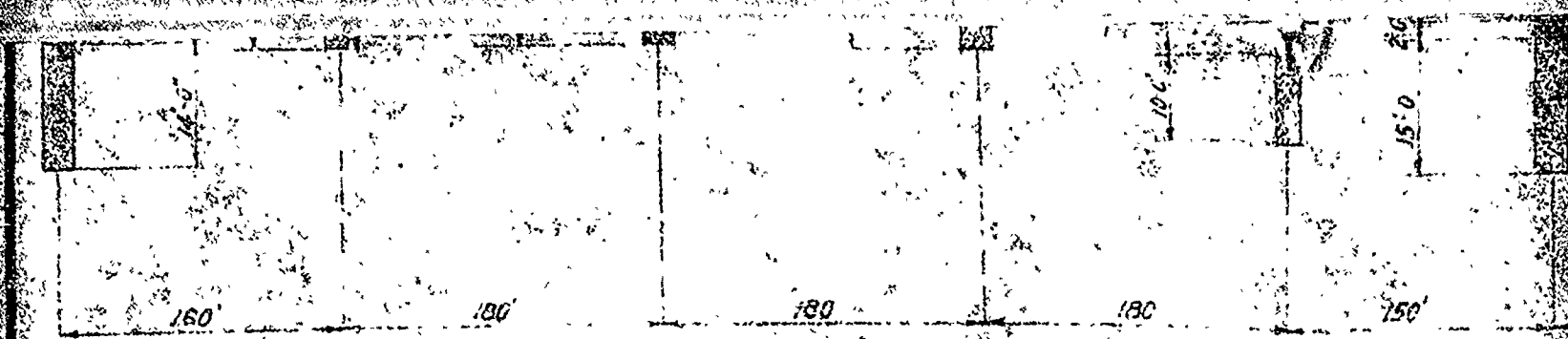


-  Sand, clay and small stones
-  Shale
-  Boulder
-  Sand and boulders
-  Sand and small stones
-  Clay



APPROVED.

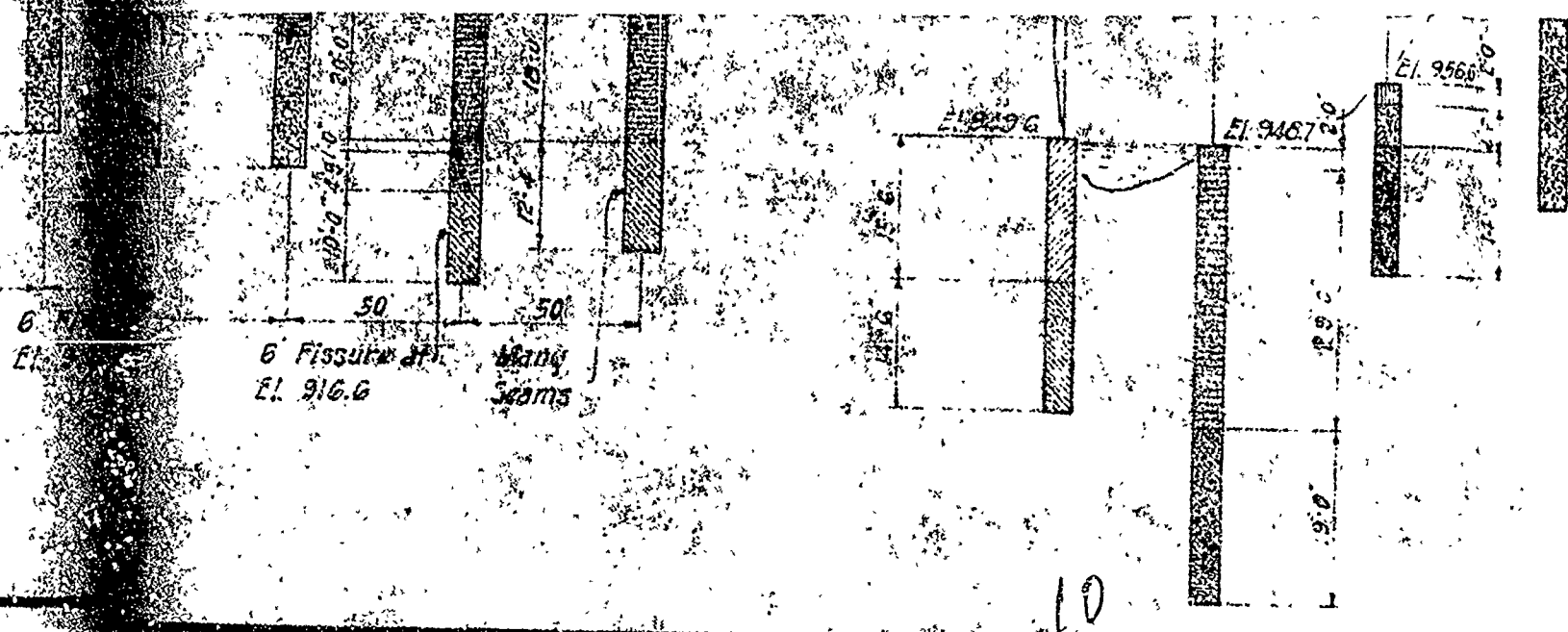
CHAS. T. MAIN, CONSULTING ENG.  
200 DEVONSHIRE ST.



ORDER NUMBERS

9

6  
E1



CAT

REV

11  
THIS DRAWING IS THE PROPERTY OF CHARLES H. TENNEY & CO.  
AND IS SUBJECT TO RETURN ON DEMAND.

BOSTON, MASS.

12

BY *Chas. J. Main*

CAT

REV

CATSKILL POWER CORP. MIDDLETOWN, N.Y.

REVISIONS

SWINGING BRIDGE  
DEVELOPMENT  
BORINGS

Drawn

Traced

Checked

J.D.F.

O.K.B.

Examined:

Eng.

PREPARED BY CHARLES H. TENNEY & CO.  
ENGINEERS BOSTON, MASS.

Approved:

*W. F. L. L.*

SCALES

1" = 100'

1" = 20'

SEPT. 9, 1925

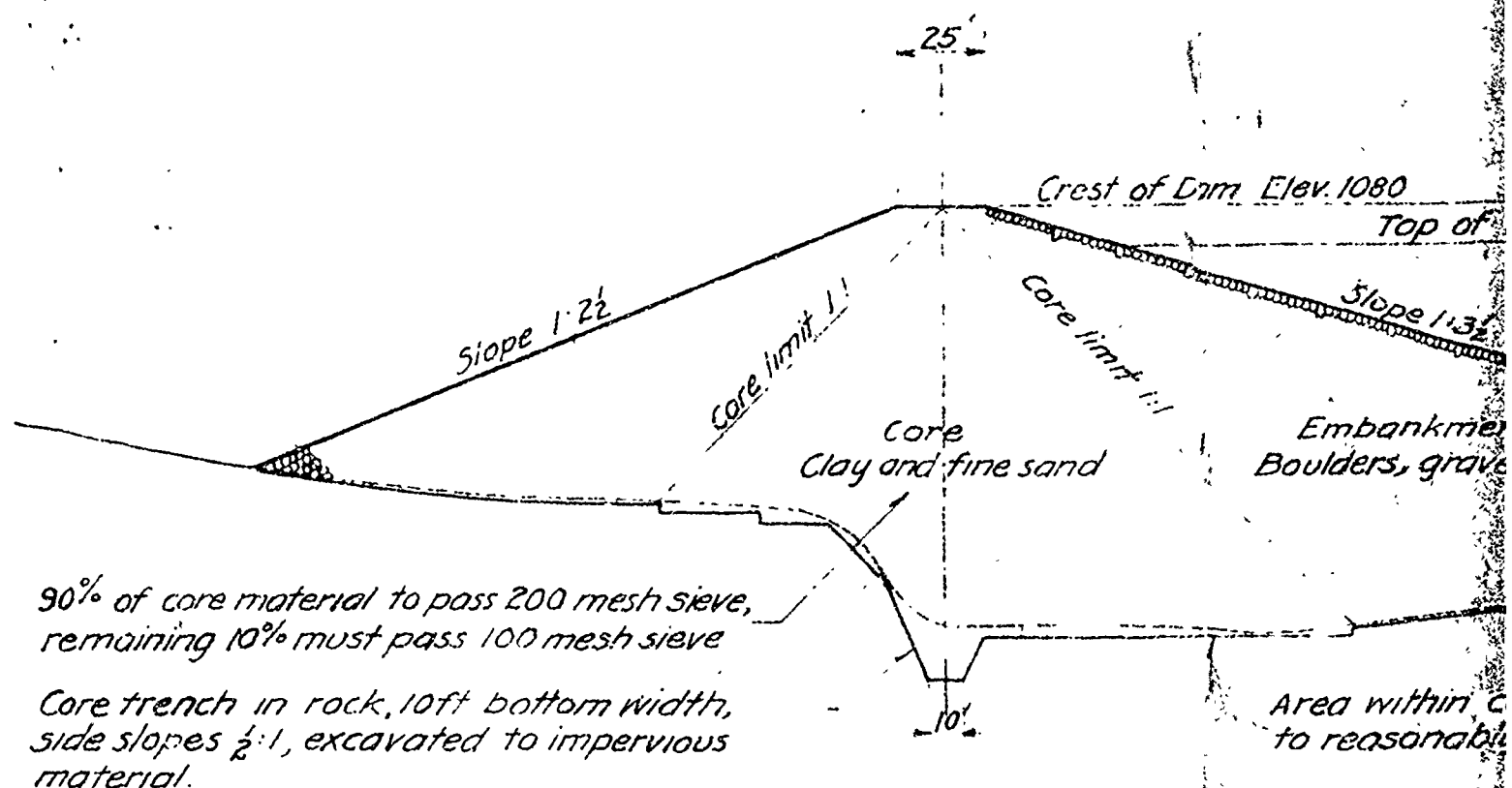
KK

3

16

& CO.





### CROSS SECTION OF DAM AT STA 2+00

Scale 1" = 50'

Note, This cross section is typical between Stations 0+00 and 2+40

F. O. 428.90

2

Top of Flashboards Elev 1070.

Top of Flashboards Elev 1070.

1:1 1/2

Riprap upstream Face

ankment  
gravel and sand.

Rockfill Toe, Material  
from Spillway Channel

Area under dam to be stripped  
of all vegetable matter

thin, core  
within core limits to be excavated  
sufficiently impervious material

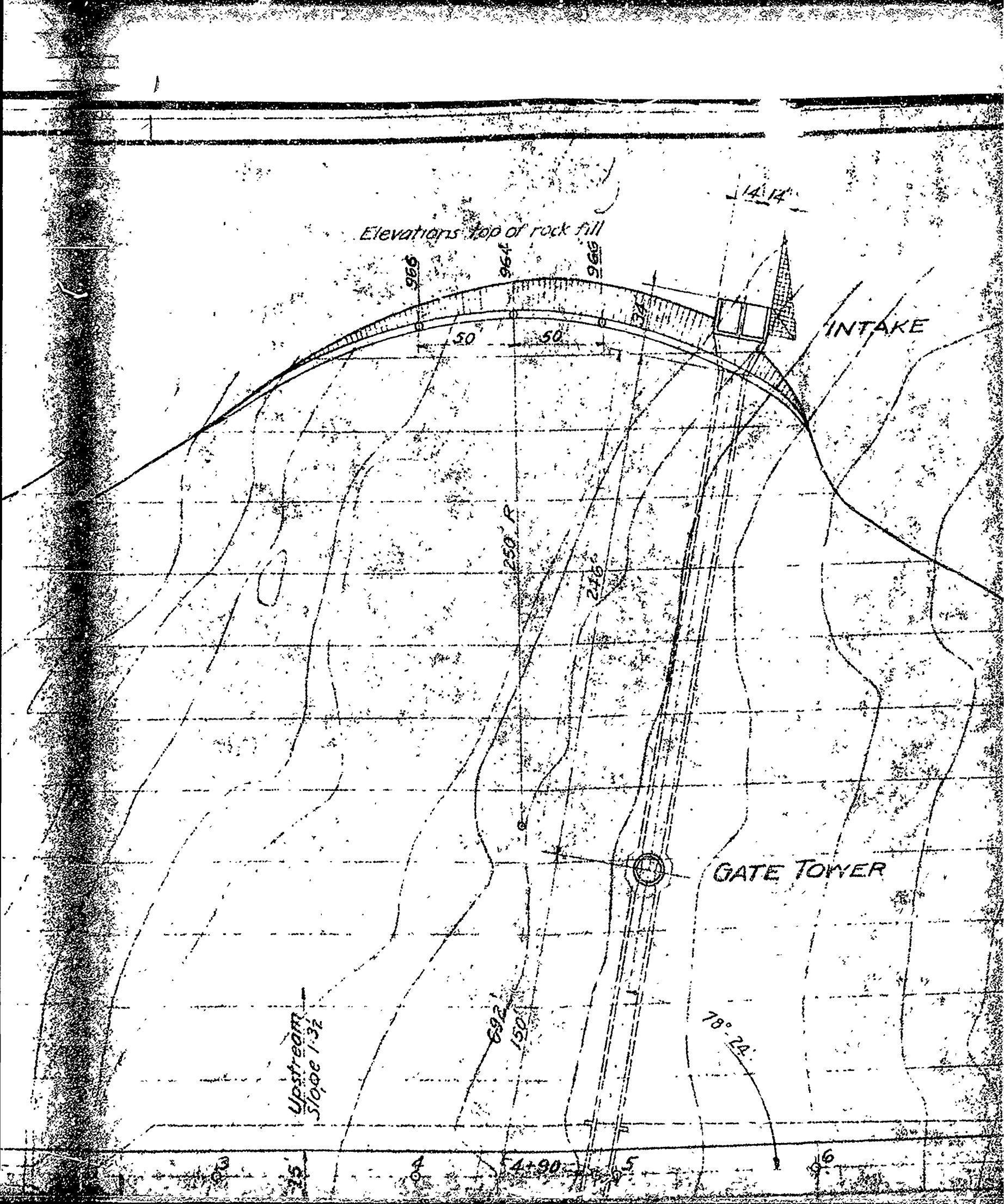
00  
00

"F" LINE

11'0"

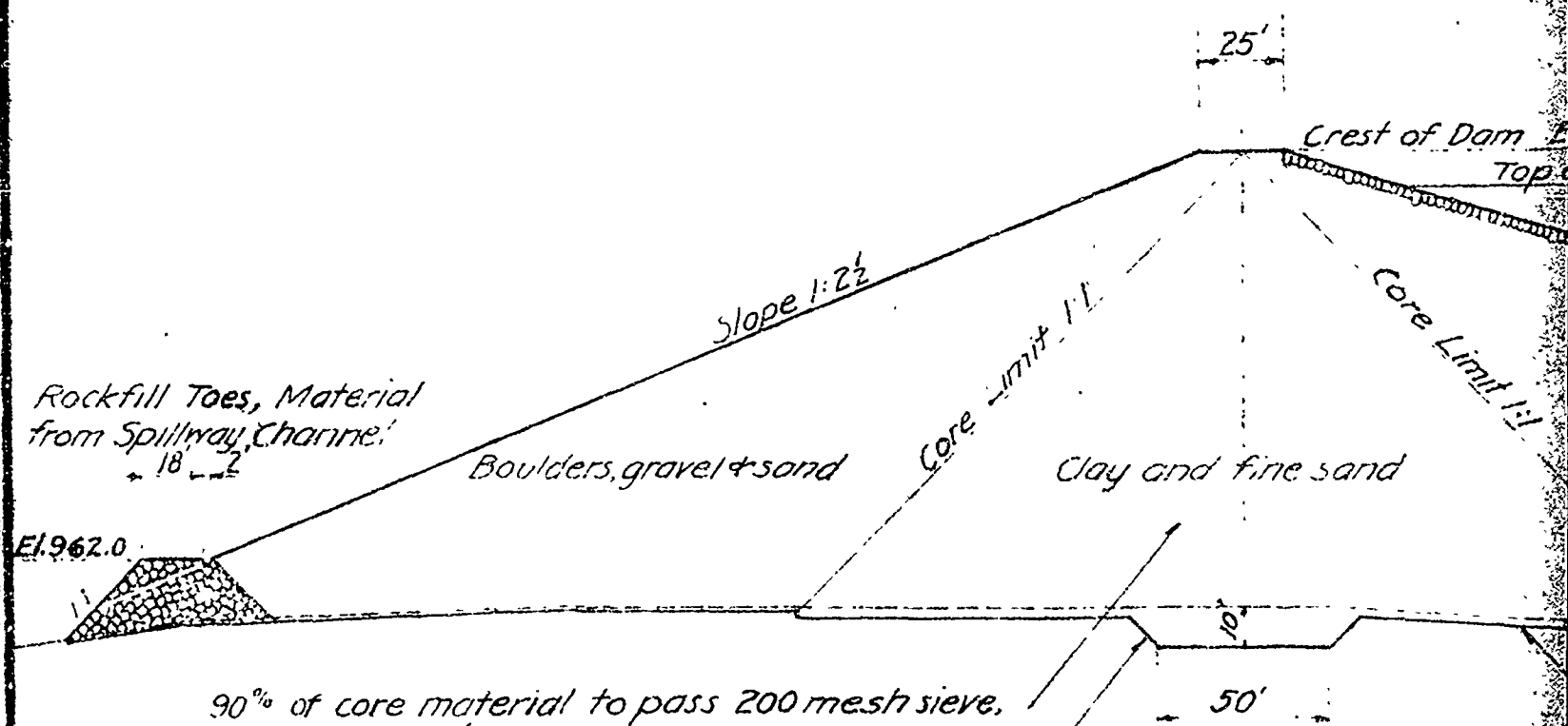
230'

100 0+00 DAM LINE





5

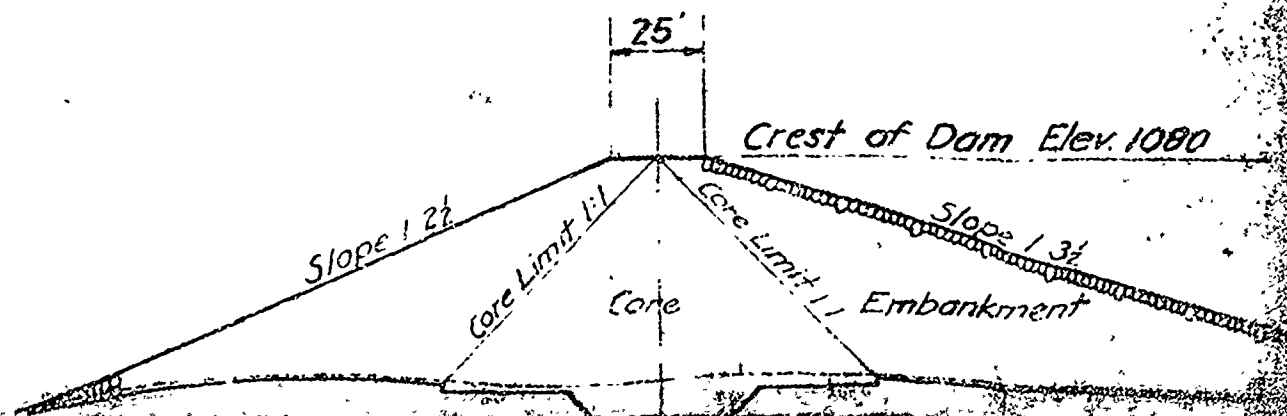


90% of core material to pass 200 mesh sieve, remaining 10% must pass 100 mesh sieve

Core trench in earth, 50ft bottom width, side slopes 1:1, excavated to impervious material

# CROSS SECTION OF DAM AT STA 2+40 Scale 1"=50'

Note; This cross section is typical Stations 2+40 and 5+00



Elev 1080  
Top of Flashboards Elev 1070 Spillway Crest Elev 1065

Slope 1:3½  
Riprap upstream face  
Boulders, gravel and sand.

Area under dam to be stripped  
of all vegetable matter.

Area within core limits to be excavated  
to reasonably impervious material

Sta. 4+00

ical between

Sta. 0+00

1+00

2+00

Riprap



CONDUIT

PLAN OF DAM Scale 1" = 50ft

100-443887-100







APPROVED

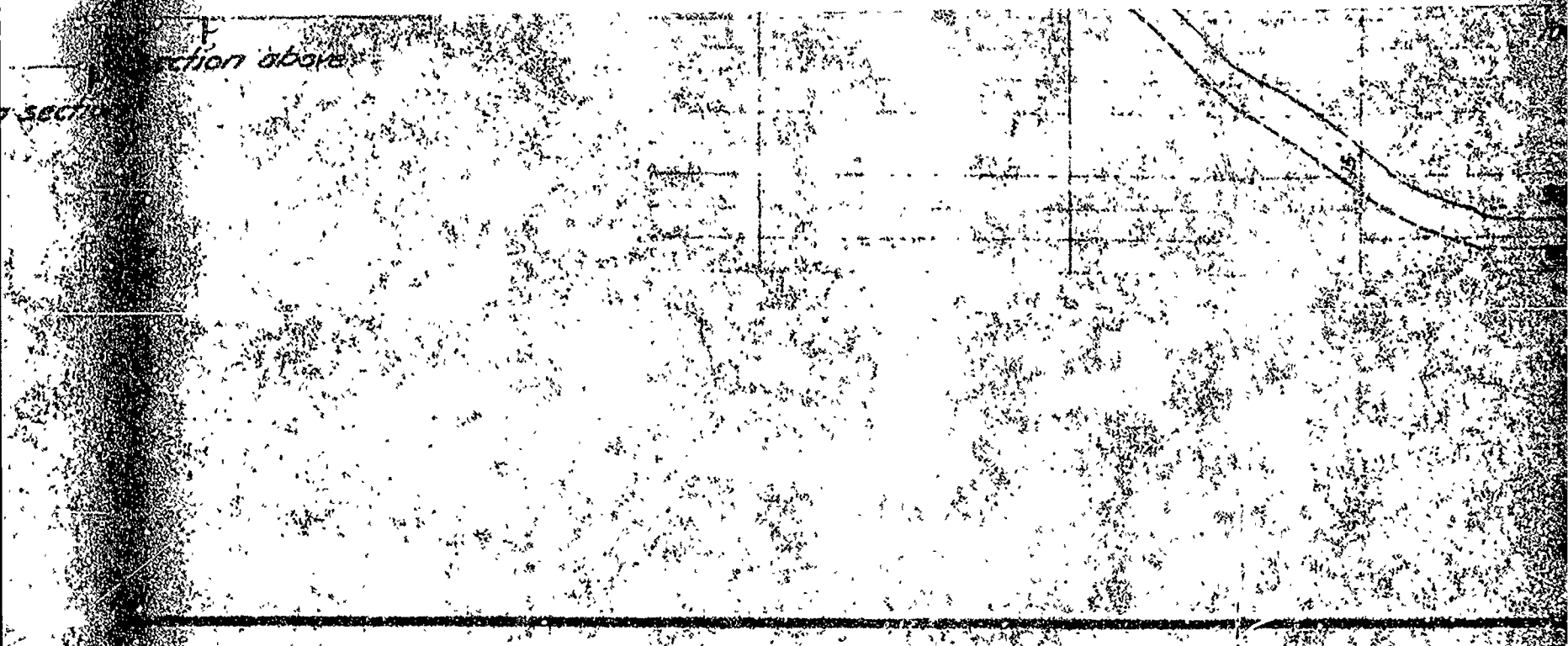
50'	at Sta 5+00
39'6"	at Sta. 7+00
25'	at Sta. 9+75

See notes on section

# CROSS SECTION OF DAM AT STA. 7+00

Scale 1"=50'

Note; This cross section is typical  
between Stas. 5+00 and 9+75.



10

1000.

1950

Bottom of Cut-off Trench

LONGITUDINAL SECTION OF DAM  
LONGITUDINAL SECTION OF DAM

50250

THIS DRAWING IS THE PROPERTY OF CHARLES H. TENNEY & CO  
AND IS SUBJECT TO RETURN ON DEMAND.

CATSKILL

## REVISIONS

A high-contrast, black and white image showing a dense, textured surface, possibly a wall or a large piece of fabric, with a prominent vertical line running down the center. The texture is grainy and noisy, with many small black specks and white highlights. The vertical line is slightly darker and more defined than the surrounding areas.

WILL  
NS

trench

200 DEVONSHIRE ST.  
BOSTON, MASS.

BY *Chas. H. Tenney*

ATSKILL POWER CORP. MIDDLE TOWN, N.Y.

REVISIONS

SWINGING BRIDGE  
DEVELOPMENT  
DAM

Drawn By (Initials) (Scale)

PRINTED

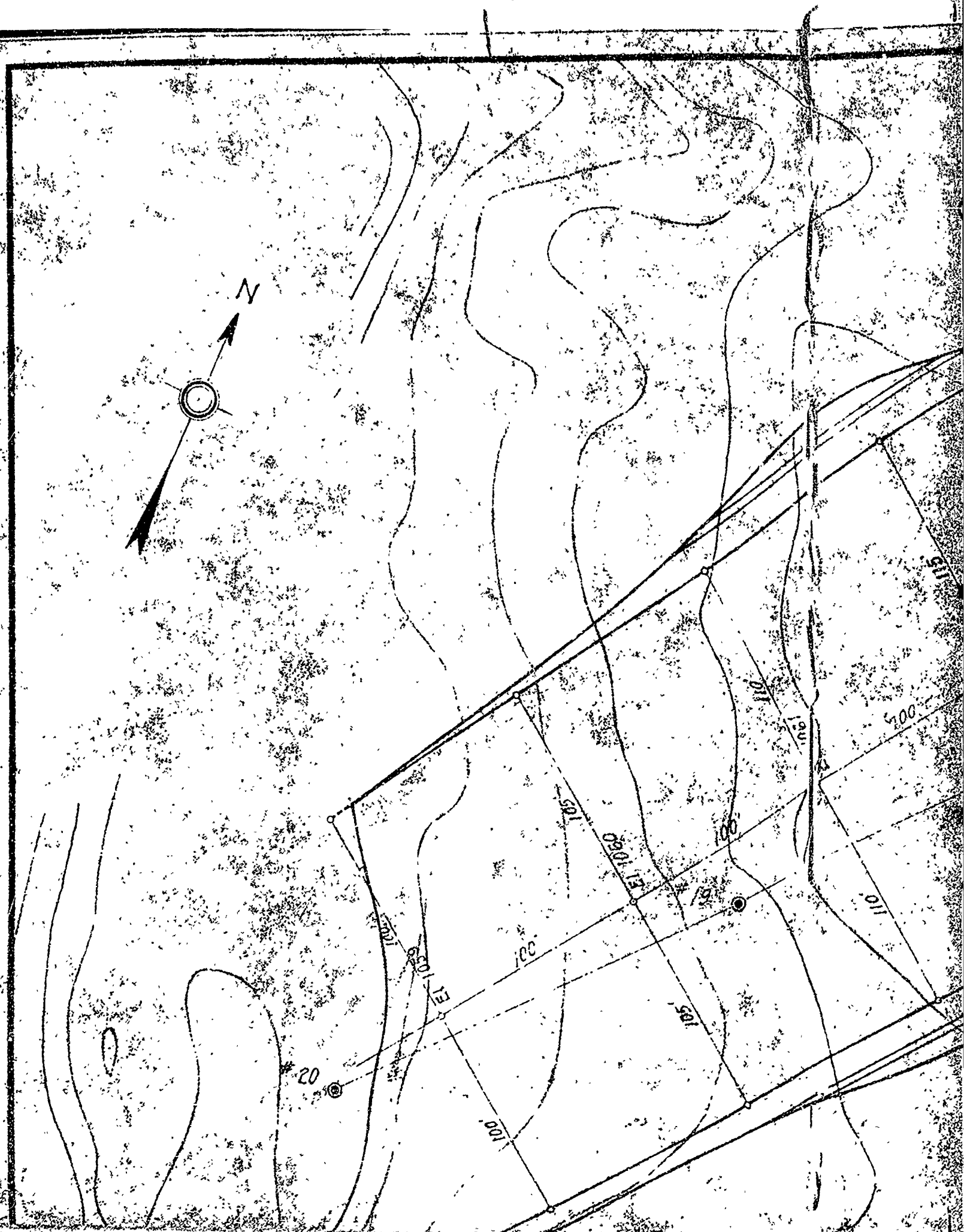
PREPARED BY CHARLES H. TENNEY & CO.  
ENGINEERS BOSTON, MASS.

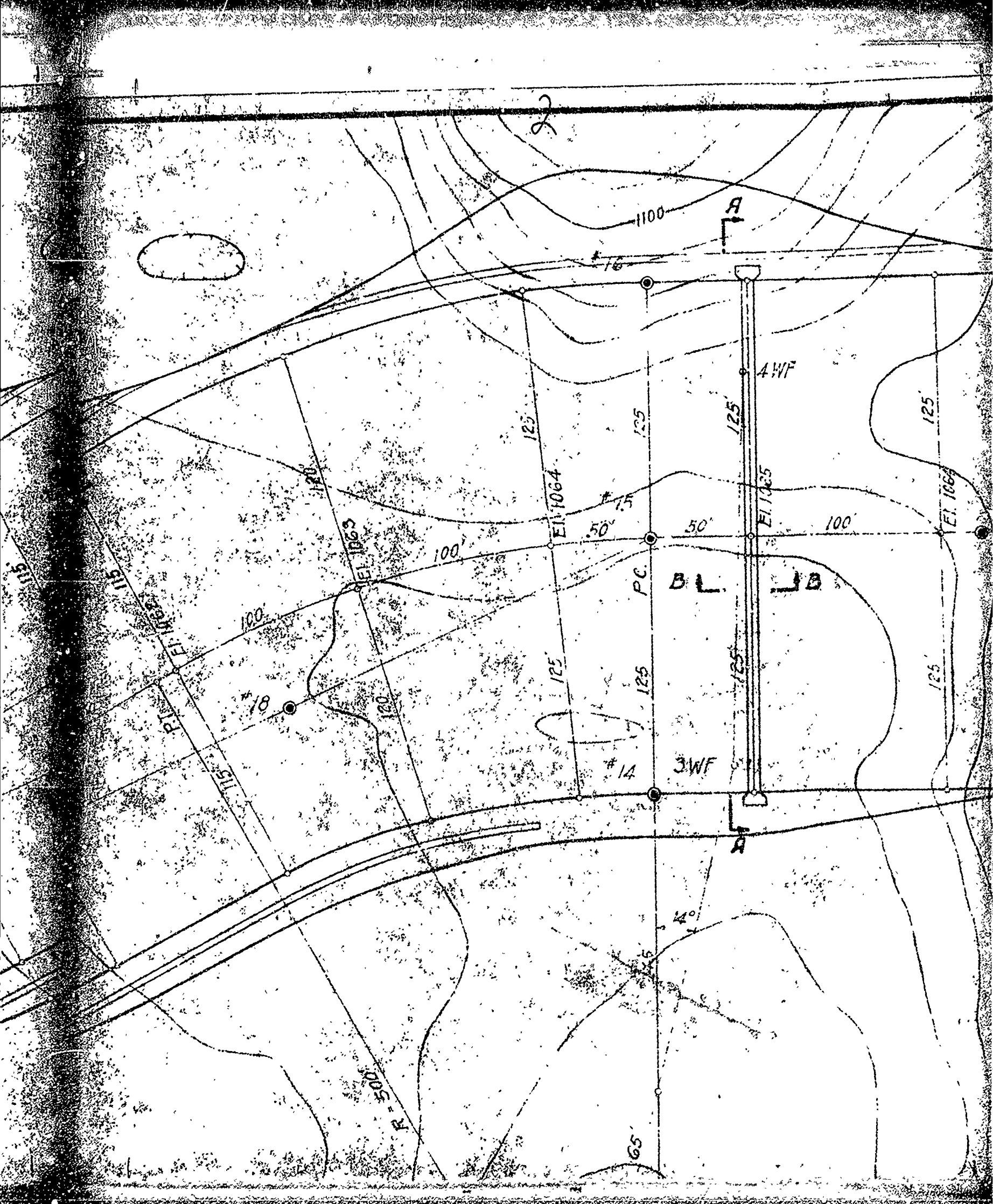
*Chas. H. Tenney*

17-5071 *SW* *11/27/17* **KM 3 17**

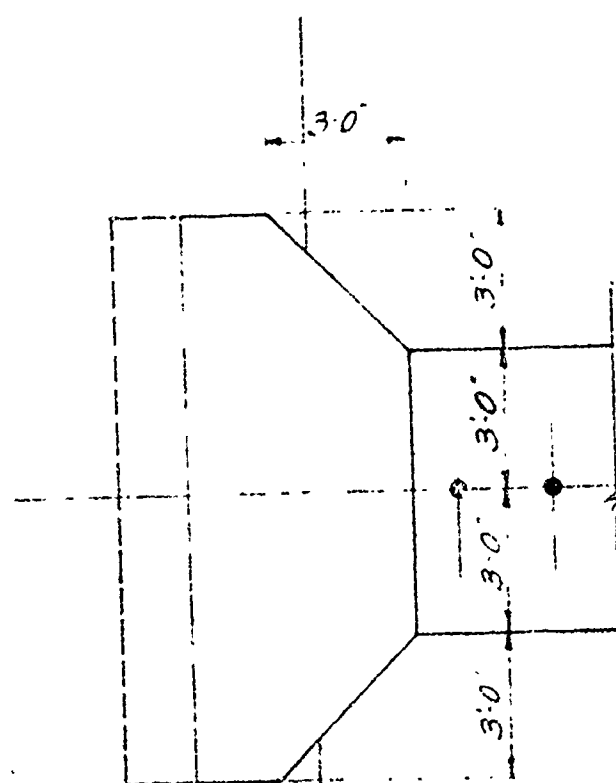
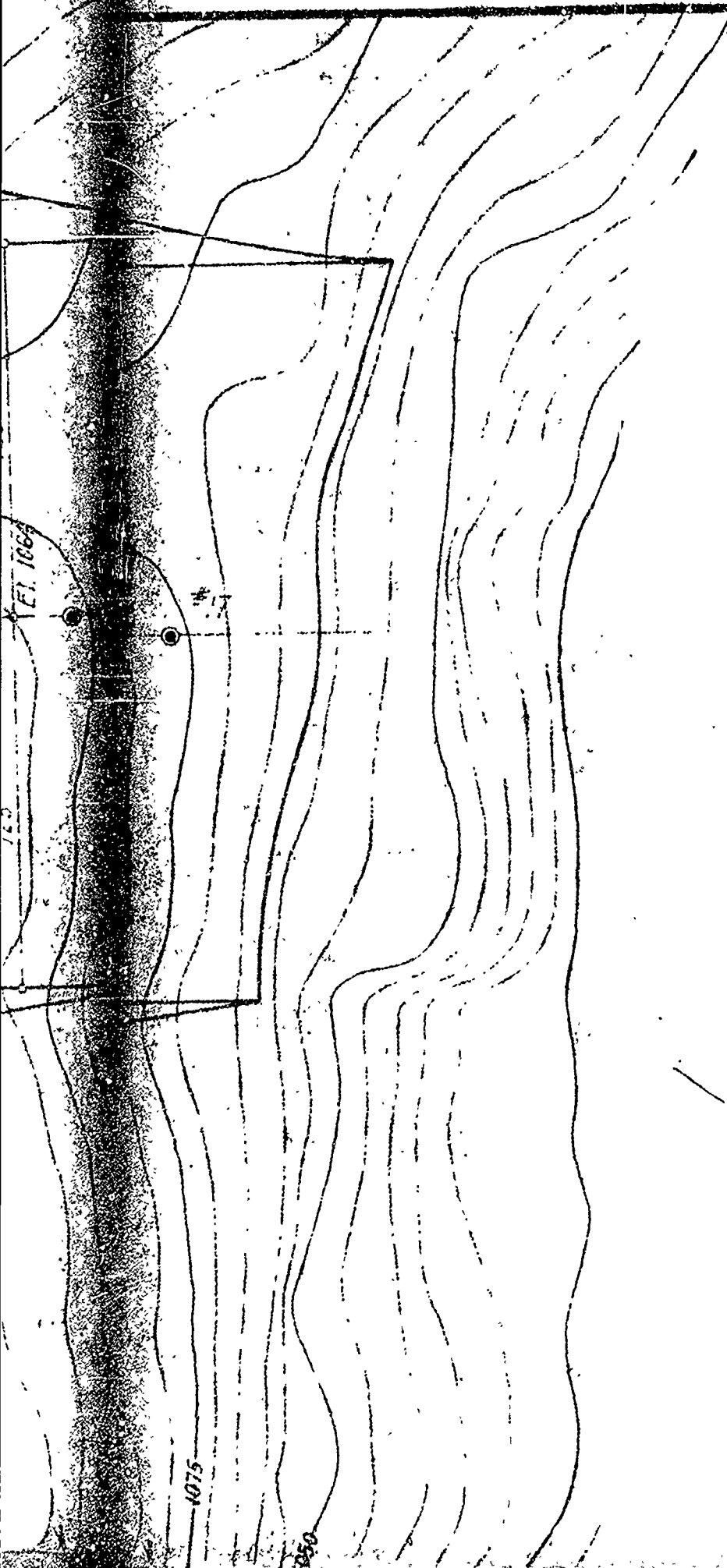
12



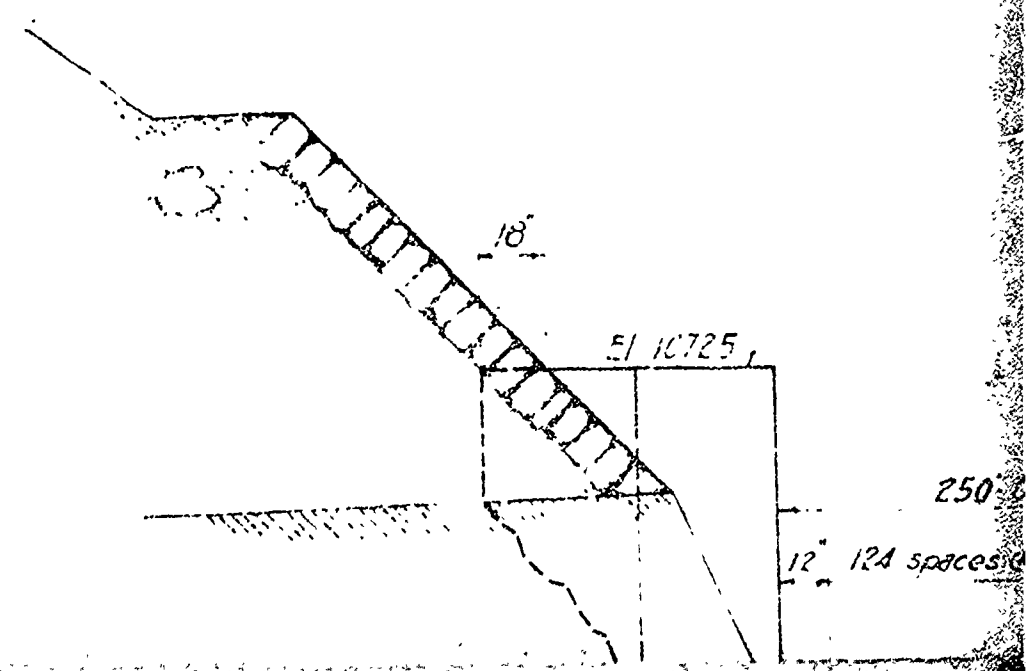




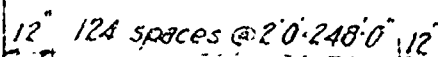
3

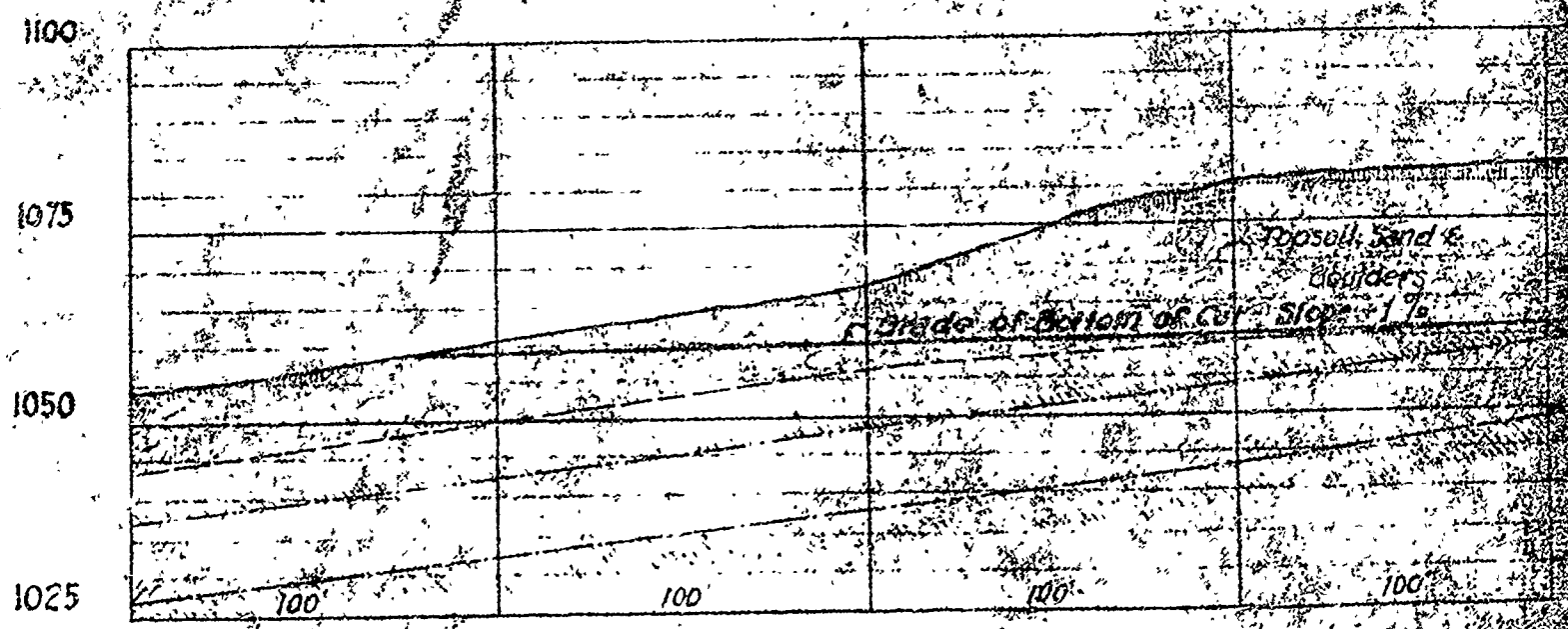


PLAN OF SA  
Scale: 1/4"

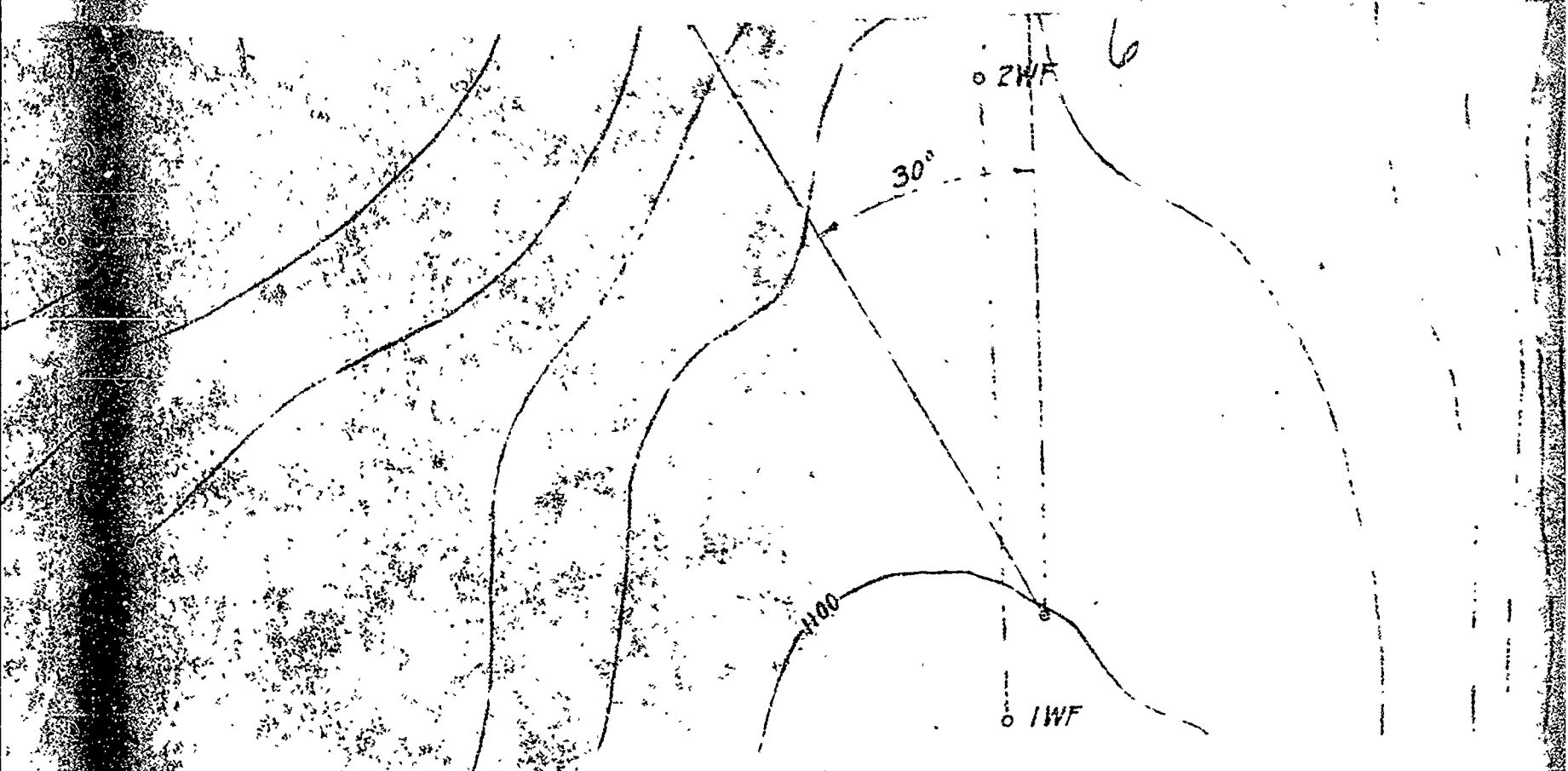






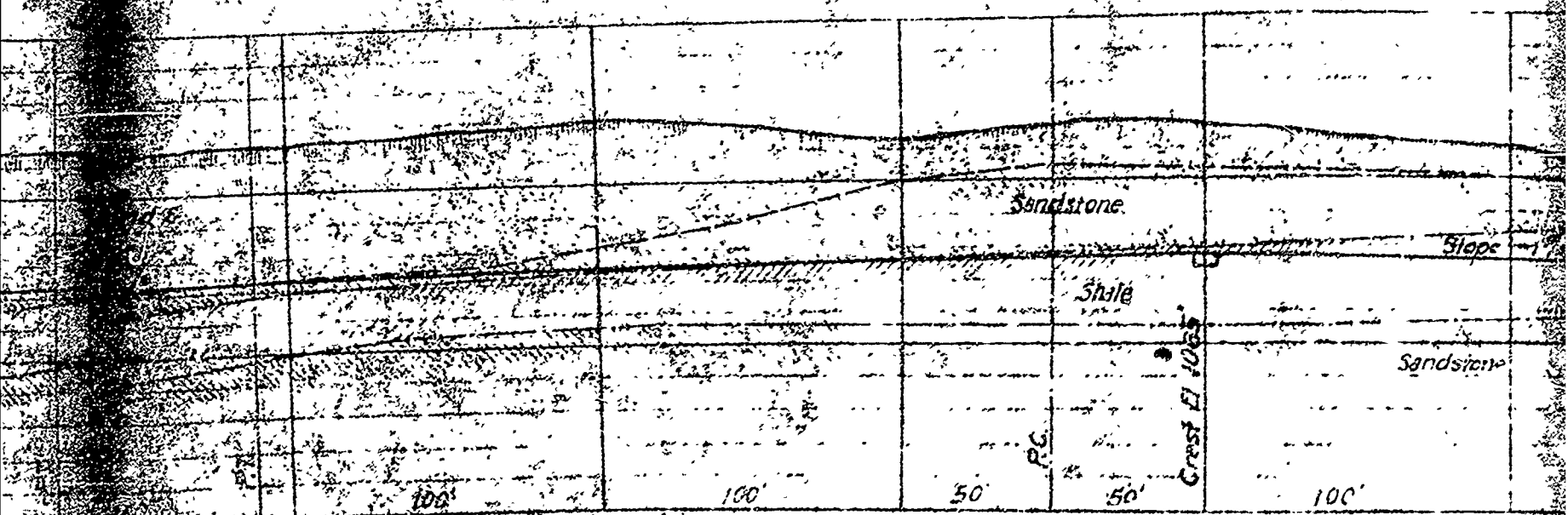


PROF.



PLAN

Scale 1" = 50'



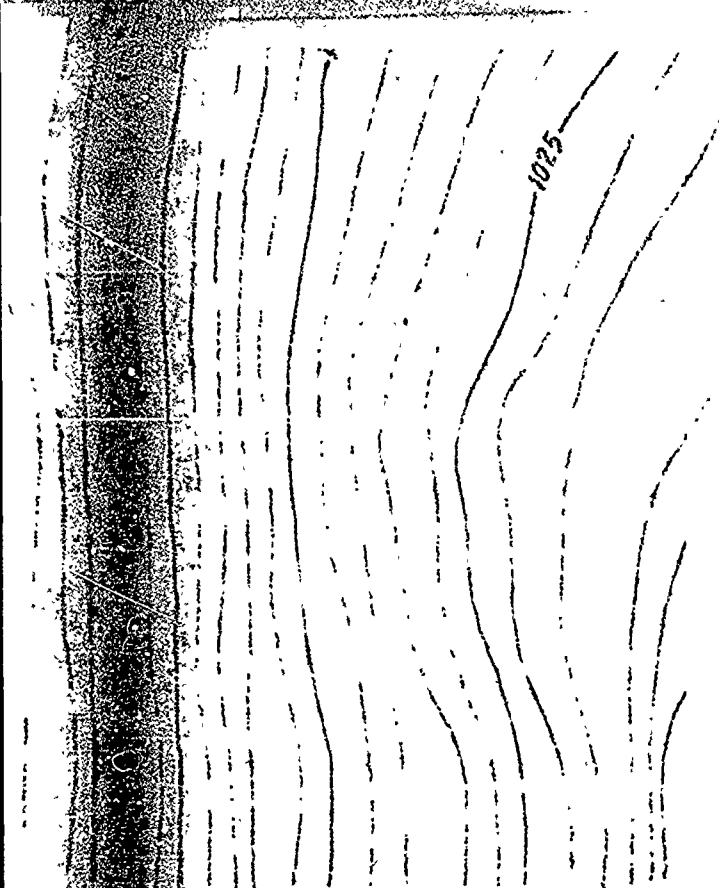
PROFILE ON C OF SPILLWAY

Horizontal Scale 1" = 50'

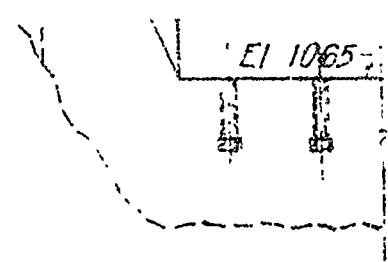
Vertical Scale 1" = 25'

(Grade of rock lines approximate only!)

Side slopes in Rock to be 1:2, in Sand & Gravel slope to be 1:1 to 1 1/2 above grade of bottom of cut and slope



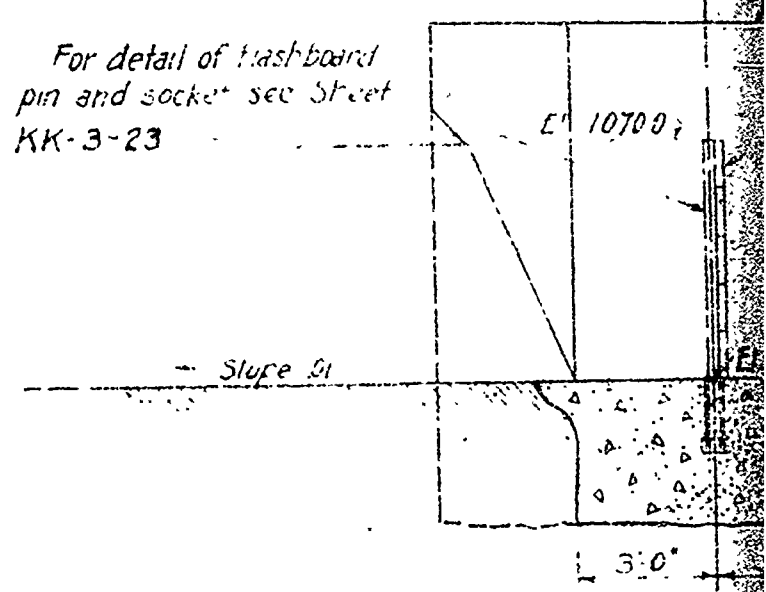
7.



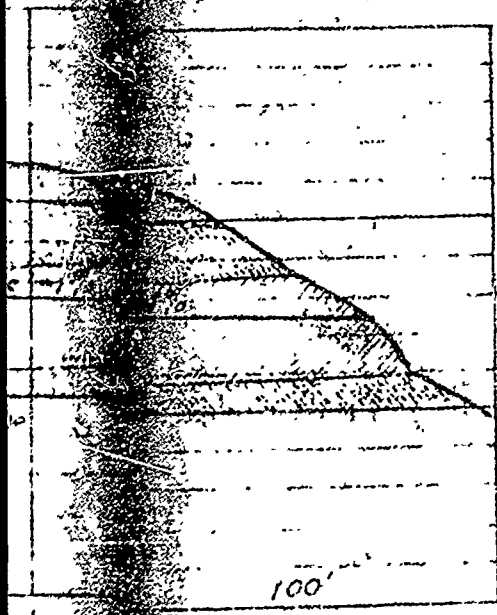
SECTION

Scale: 1/4"

For detail of trashboard  
pin and socket see Sheet  
KK-3-23



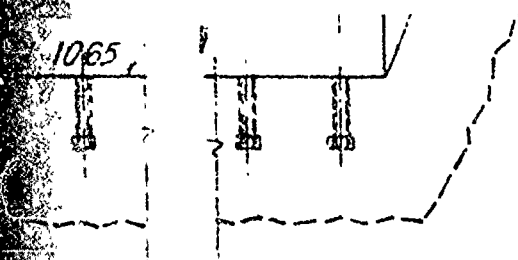
SECTION



Quantities :-

Excavation - Sand & Boulders	83,000 cy
Excavation - Rock	33,000 cy.
Riprap	1,800 sy
Concrete at Spillway	200 cy.

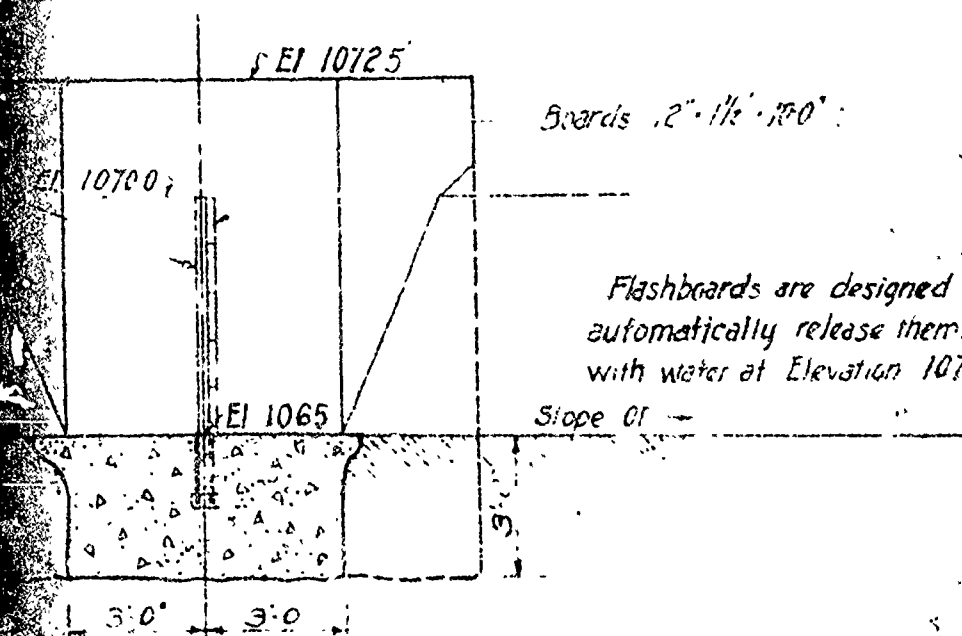
1 slope 5:1



8

# SECTION "A-A"

Scale: 1/4" = 1'-0"



# SECTION "B-B"

APPROVED:

CHAS. T. MAIN, CONSULTING ENGR.  
200 DEVONSHIRE ST.

Top Soil Sand  
& Boulders

Plumb

Shale

# SECTION THRU BORINGS

Horizontal Scale  
Vertical Scale

9



Ripraped, leave 3' Berm above Riprap, all other side slopes in Sand & Gravel to be 1 1/2 : 1.

All rock surfaces shall be reasonably smooth and sound. Bad places shall be improved with concrete.

Sandstone

Sandstone

1956, 15 & 16

1950

222

10

CATSKILL

REVISIONS

11  
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AND IS SUBJECT TO RETURN ON DEMAND



BOSTON, MASS.

BY

*Chas. H. Tenney*

12

KILL KILL POWER CORP. MIDDLETOWN, N.Y.

SWINGING BRIDGE  
DEVELOPMENT  
SPILLWAY

Design Traced Checked

DVCEB DVCEB

Examined:

1st. Examiner

Approved:

*W. F. Hall*

PREPARED BY CHARLES H. TENNEY & CO.  
ENGINEERS BOSTON, MASS.

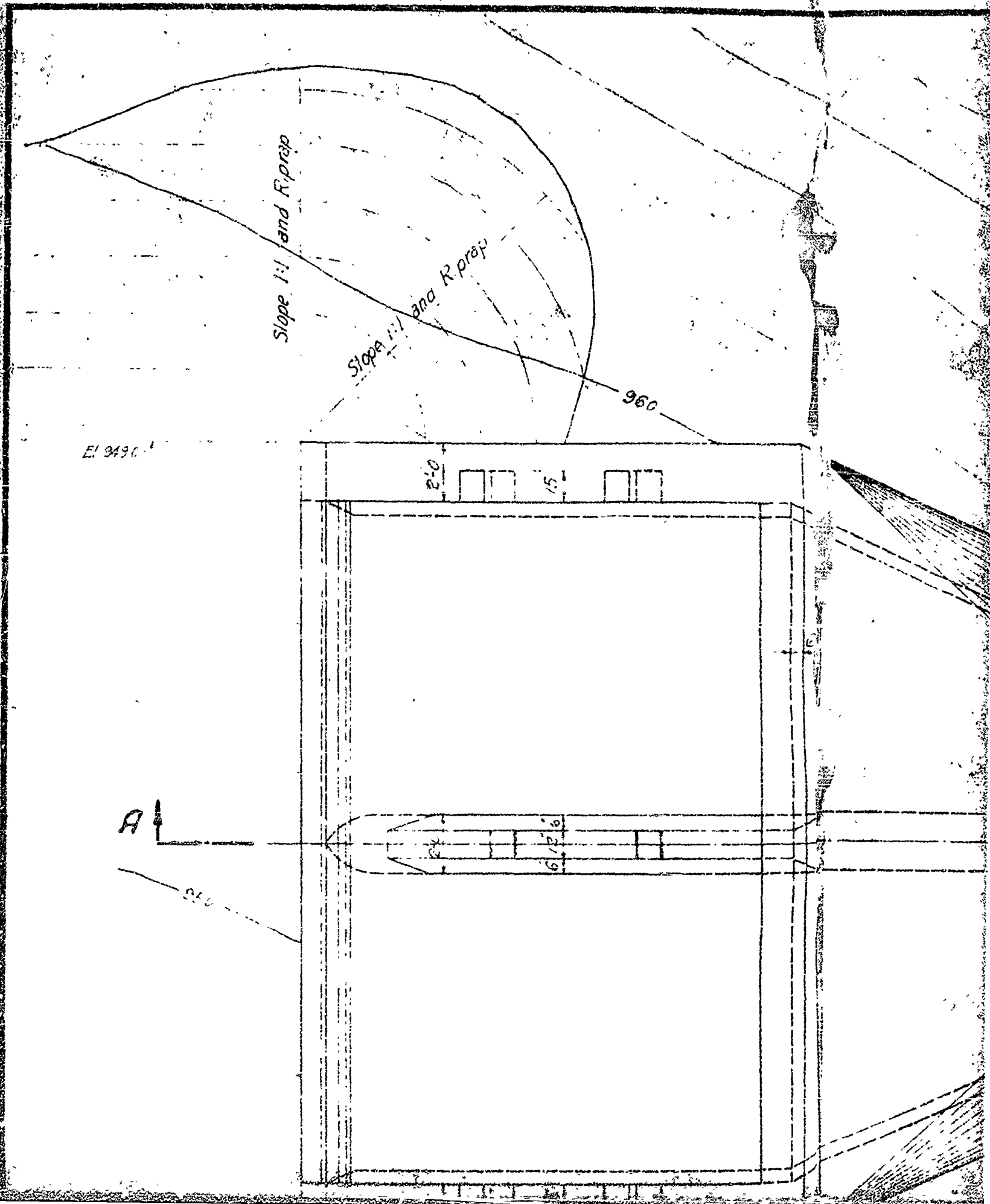
SCALE

1" = 25' 1/4" = 10'

SEPT 1925

KK 3 18

25 Y 32



2

(H)

396.0" to 4 Dam

 $\epsilon^{1/2}$ 

A

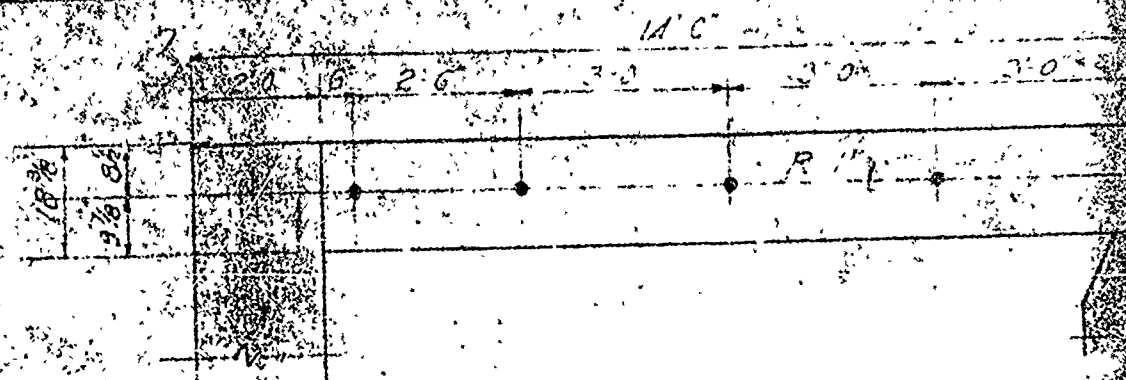
A-162-

P 157

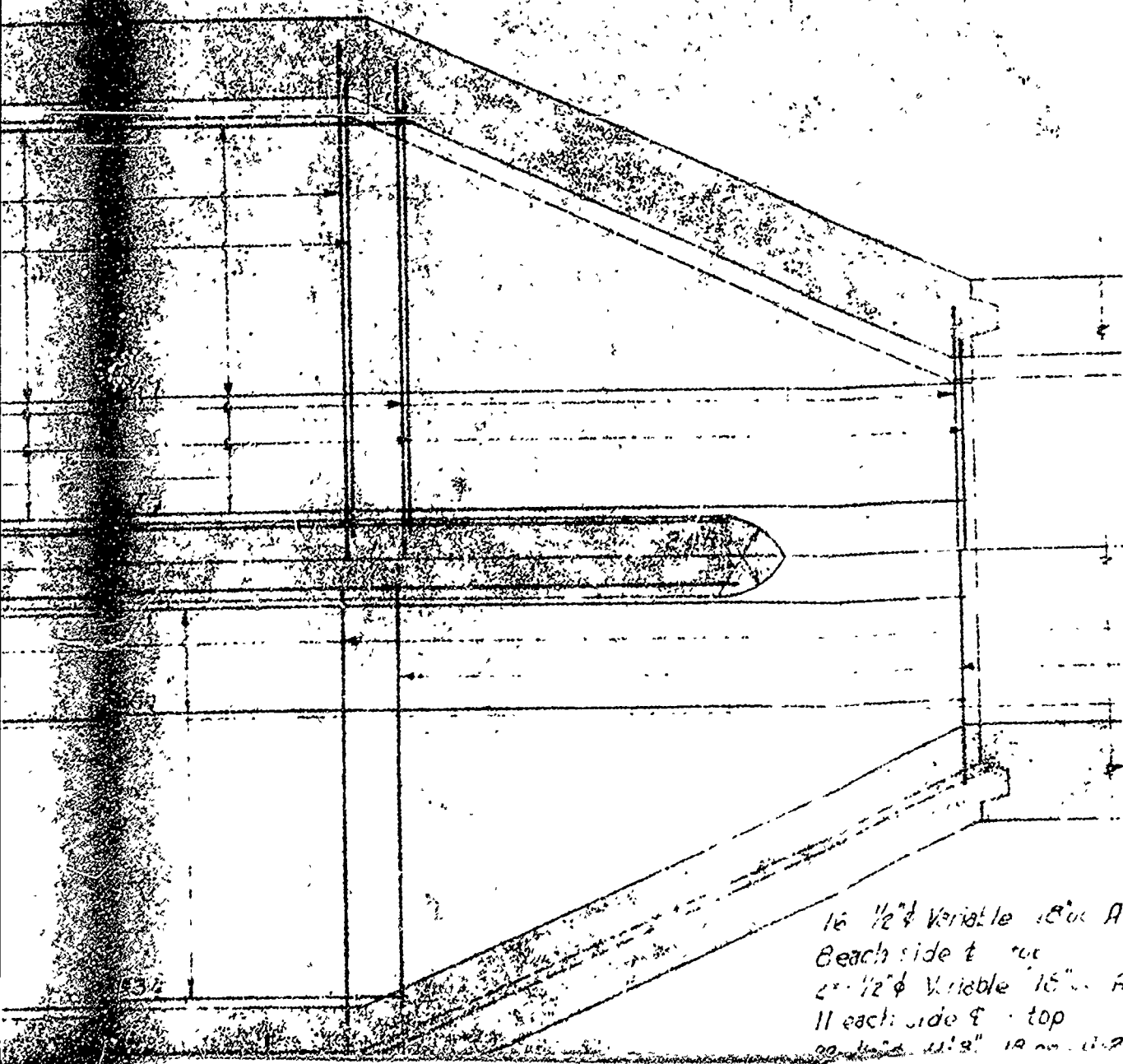
A-167

A 195;

193



ANCHOR BOLT LOC



16 1/2" Variable 18' A-193-198 }  
 Beach side t. ruc  
 2" 1/2" Variable 16' A-199-209 }  
 11 each side & top  
 20 1/2" 11' 3" 19' 11' 21' }

LOCAT

ION DETAIL AT 'X'

REIN

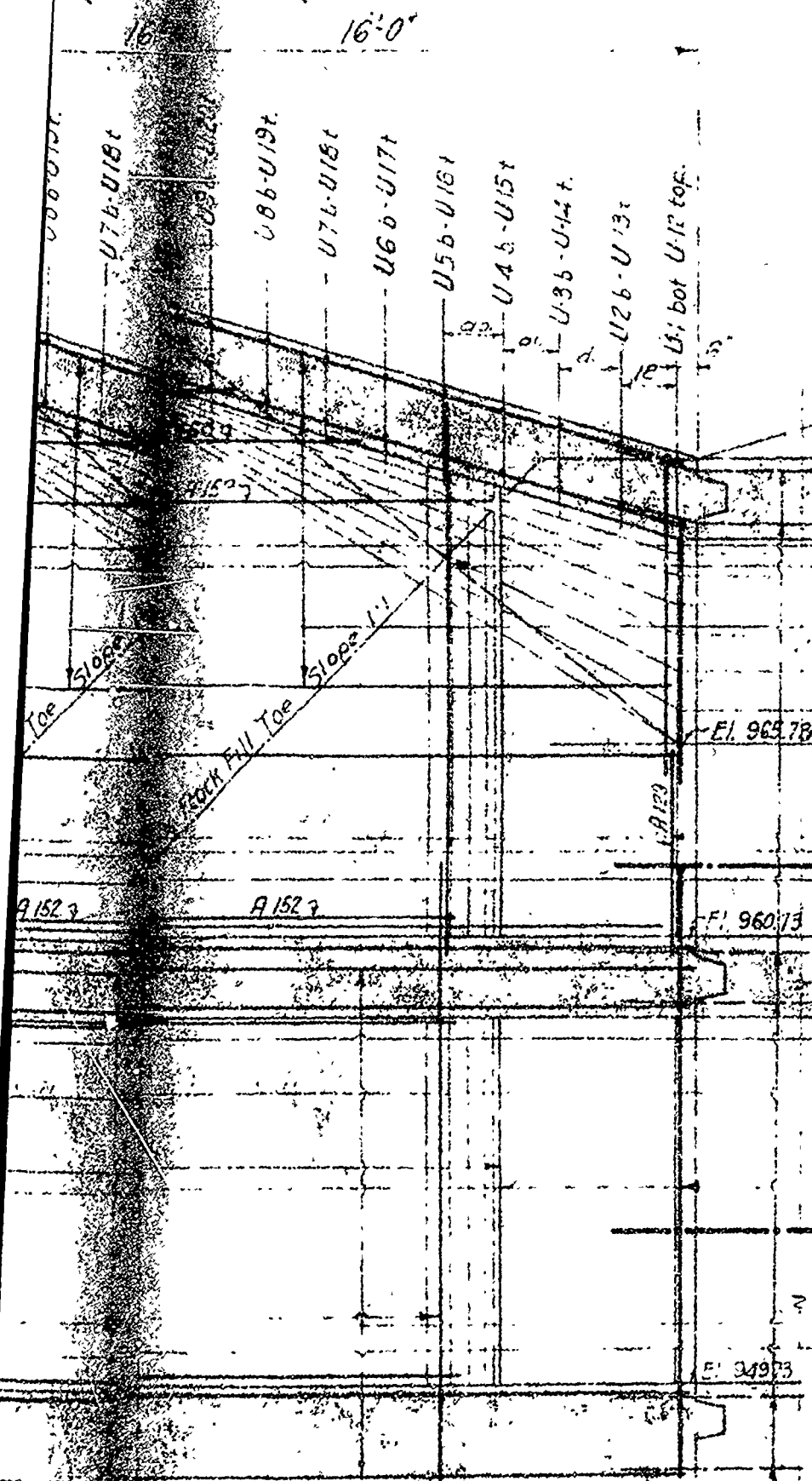
# REINFORCEMENT SCHEDULE

DESCRIPTION	Mark	Nº Reg'd	Size	Length
Length	A 99	8	1/2" φ	15'-6"
	A 100	4	1/2" φ	13'-0"
	A 101	32	1/2" φ	15'-0"
	A 102	2	1/8" φ	26'-0"
	A 103-109	14 (2 ea)	1/2" φ	16'-0" to 13'-3"
	A 110-118	36 (4 ea)	1/2" φ	3'-9" to 16'-0"
	A 119-129	44 (4 ea)	1/2" φ	16'-0" to 1'-6"
	A 130-137	16 (2 ea)	1/2" φ	2'-0" to 12'-9"
	A 138-143	24 (4 ea)	1/2" φ	3'-0" to 10'-6"
	A 144-147	16 (4 ea)	1/2" φ	28'-3" to 32'-6"
	A 148	40	1/2" φ	17'-6"
	A 149	44	1/2" φ	15'-6"
	A 150	32	1/2" φ	33'-6"
	A 151	14	1/2" φ	26'-0"
	A 152-159	16 (2 ea)	1/2" φ	22'-6" to 12'-0"
	A 160-161	4 (2 ea)	1/2" φ	8'-6" to 4'-0"
	A 162-166	20 (4 ea)	1/2" φ	17'-6" to 30'-6"
	A 167	12	1/2" φ	32'-0"
	A 168-178	22 (2 ea)	1/2" φ	11'-0" to 4'-6"
	A 179-189	11	1/8" φ	26'-6" to 13'-9"
	A 190	22	1/2" φ	11'-6"
	A 191	11	1/8" φ	27'-0"
	A 192	4	1/8" φ	27'-6"





# SECTION BE



2-7/8" - 20' - 12" oc A-102

{ 14-1/2" Variable 18" oc A-103-109  
7 each n.s. & f.s. center wall

{ Spacers 1/2" 18" oc (approx)  
n.s. & f.s. n. wall & f. wall

{ 80-1/2" Variable 18" oc A-110-129

{ 20 each n.s. & f.s. n. wall & f. wall

{ 16-1/2" Variable 18" oc A-130-137

{ 8 each n.s. & f.s. center wall

B

{ 24-1/2" Variable 18" oc A-138-143

{ 6 each n.s. & f.s. n. wall & f. wall

{ 16-1/2" Var. 18" oc A-144-147

{ 4 each n.s. & f.s. n. wall & f. wall

{ 40-1/2" 17'6" 18" oc A-148

{ 10 each n.s. & f.s. n. wall & f. wall

{ 42-1/2" 15'6" 18" oc A-149

{ 11 each n.s. & f.s. n. wall & f. wall

C

{ 32-1/2" 9'6" 18" oc A-150

{ 8 each n.s. & f.s. n. wall & f. wall

{ 14-1/2" 26'0" 18" oc A-151

{ 1 each n.s. & f.s. center wall

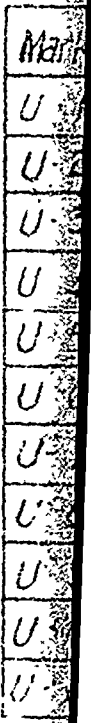
{ 20-1/2" Variable 18" oc A-152-161

{ 10 each n.s. & f.s. center wall

All longitudinal Conduit for force  
ment to be carried through centrally

7

7



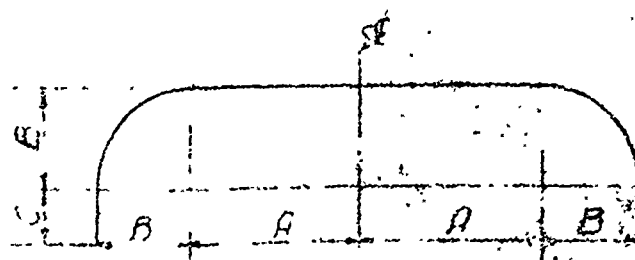


A 193-197	10 (2 ea)	1/2" $\phi$	31'6" to 18'0"
A 198	6	1/2" $\phi$	32'9"
A 199-203	22 (2 ea)	1/2" $\phi$	10'6" to 6'0"
A 210	22	1/2" $\phi$	11'3"
Spacers		1000 lf	1/2" $\phi$

\* Cut bars to fit at "Y"  
Use deformed bars

### BENDING TABLE FOR U-1 to U-22

Mark	A	B	C	Length	Mark	A	B	C	Length
U-1	0'0"	5'3"	1'0"	16'6"	U-12	5'2"	6'6"	1'0"	23'3"
U-2	1'2"	4'9"	1'0"	19'3"	U-13	1'9"	5'9"	1'0"	23'9"
U-3	2'5"	4'4"	1'0"	20'0"	U-14	3'2"	5'1"	1'0"	24'3"
U-4	3'5"	3'10"	1'0"	21'0"	U-15	4'6"	4'5"	1'0"	25'0"
U-5	4'6"	3'5"	1'0"	21'9"	U-16	5'11"	3'8"	1'0"	25'3"
U-6	5'6"	2'10"	1'0"	22'6"	U-17	7'3"	3'0"	1'0"	25'9"
U-7	6'3"	2'5"	1'0"	23'3"	U-18	8'7"	2'3"	1'0"	26'3"
U-8	7'1"	1'11"	1'0"	24'0"	U-19	9'1"	1'7"	1'0"	26'9"
U-9	8'0"	0'6"	1'0"	24'9"	U-20	11'4"	0'10"	1'0"	27'3"
U-10	9'2"	1'0"	1'0"	25'6"	U-21	12'8"	0'2"	1'0"	27'9"
U-11	11'5"	0'7"	1'0"	26'3"	U-22	13'6"	0'0"	1'0"	29'0"



TYPICAL U-BAR FOR TOP OF INTAKE

Use 1/8"  $\phi$  See Above Table  
13k 1 of each

APPROVED:

CHAS. T. MAIN, CONSULTING ENGR.

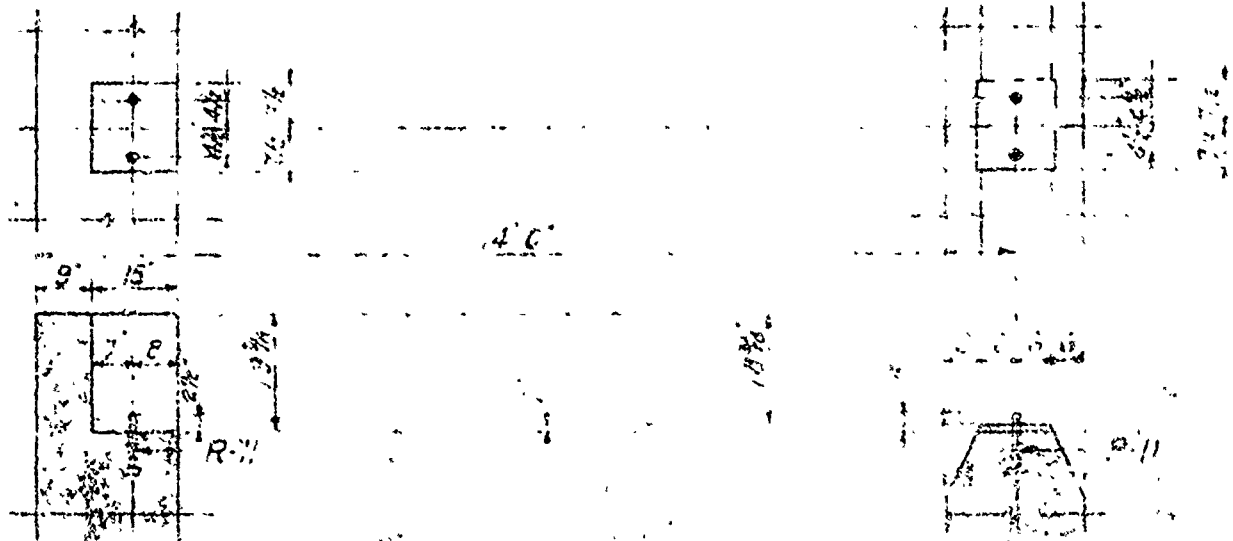
3' Spaced Sheet piling  
120' lg.

L  
D

SECTION 'AA'

ORDER NUMBER

Construction joints.



ANCHOR BOLT LOCATION DETAIL AT Y

10

DO

Notes:

Concrete Mix 1:2:4 (2000<sup>lb</sup>)

All Reinforcing Steel to be 3 from face of forms  
for General Location & Connecting Structures

see drawings KK-3-17 & KK 3-26.

For Track Rack Steel Details see drawing  
MKK-3-24.

CATSKILL

REVISIONS

THIS DRAWING IS THE PROPERTY OF CHARLES H. TENNEY & CO  
AND IS SUBJECT TO RETURN ON DEMAND

200 DEVONSHIRE ST.

BOSTON, MASS.

BY *Chas. J. Main*

SKILL POWER CORP. - MIDDLETOWN, N.Y.

VISIONS

VISIONS

SWINGING BRIDGE  
DEVELOPMENT  
INTAKE

Drawn

Traced

Checked

DVCB

DVCB

Examined

PREPARED BY CHARLES W. TENNEY & CO.  
ENGINEERS - BOSTON, MASS.

Approved:

*W. H. Allen*

SCALE

1/4" = 1'0"

OCT

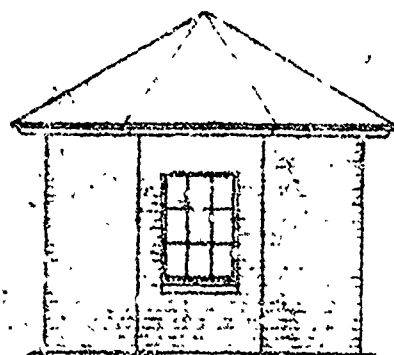
1925

KK

3

19

15'0" dia. to  
8' 13' 7" octag



10'0"

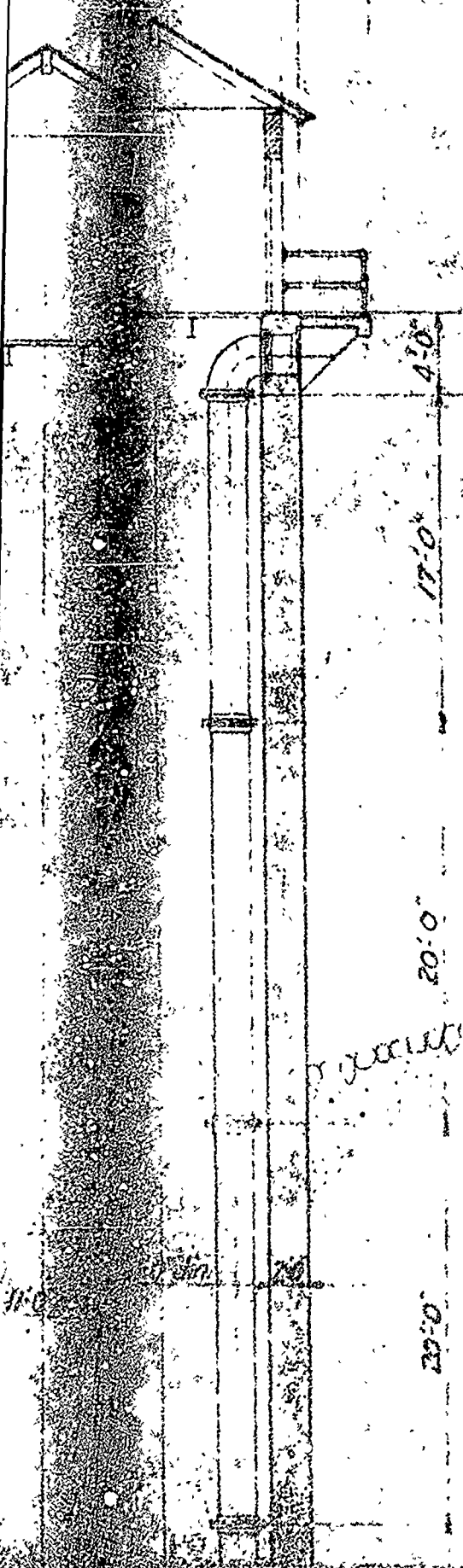
Elev. 1037

Elev. 1070 Res Full

Elev. 1040.51

Slope of dam 1:92  
111' 11" 11' 11" 11' 11"

tower  
dia. top of lantern 3'6"  
octagon

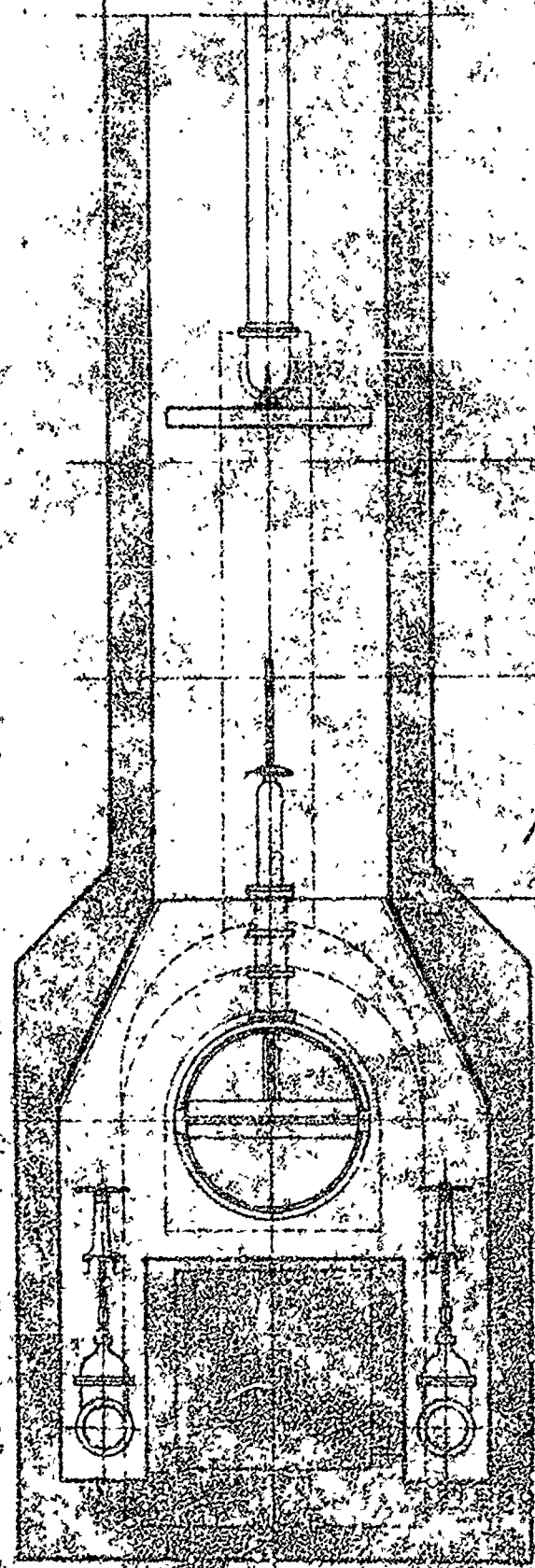


2





3

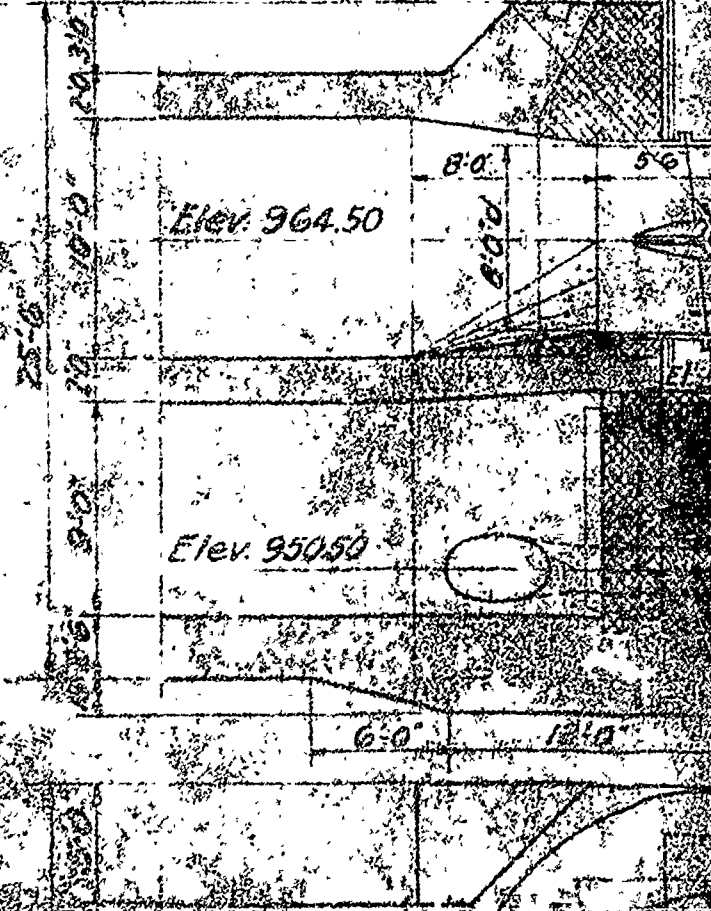


Construction joints  
complete circular key each lift

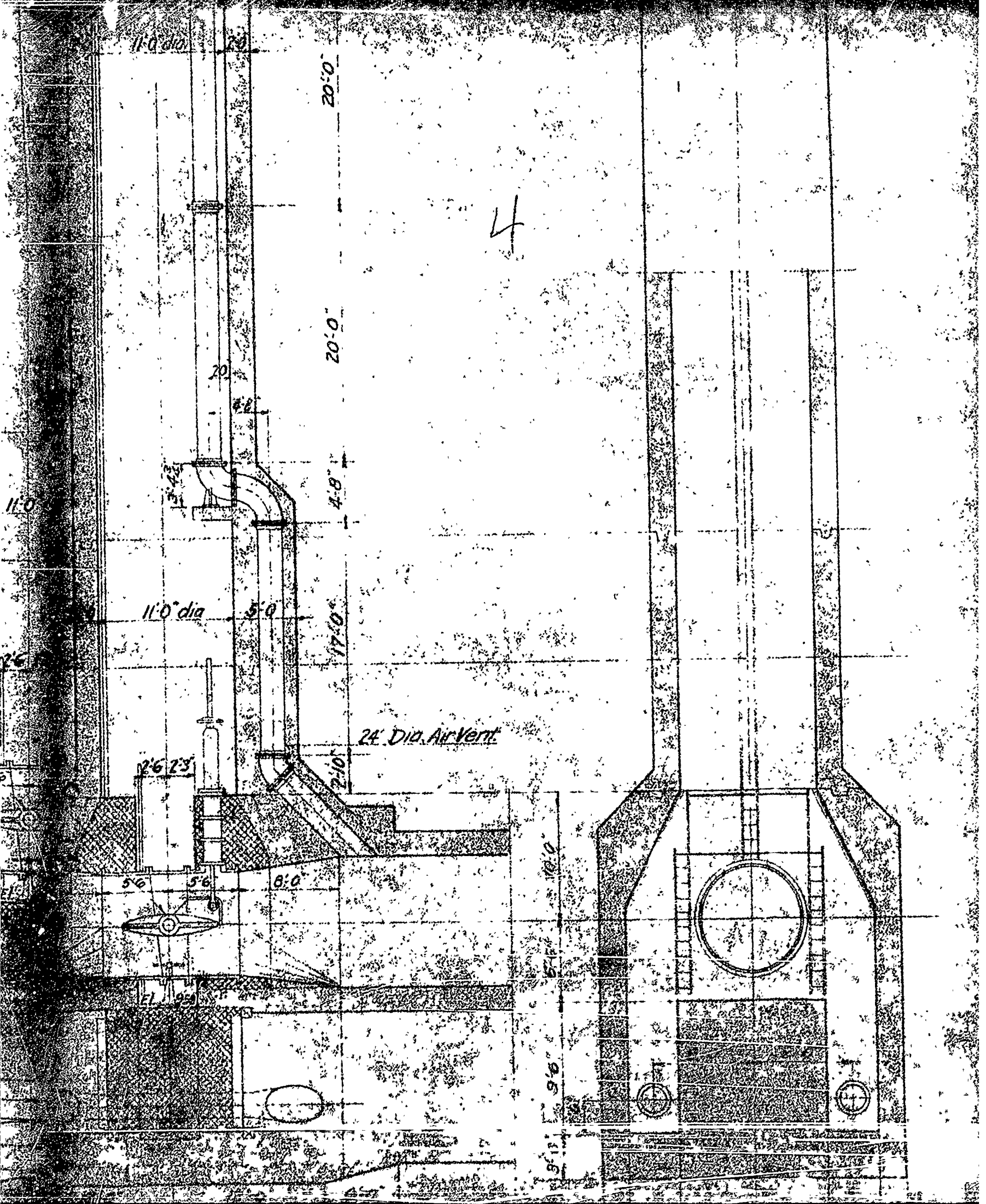
8 Ft. dia. Butterfly Valve  
Motor Operated, Remote Control.  
Elev. 974.50

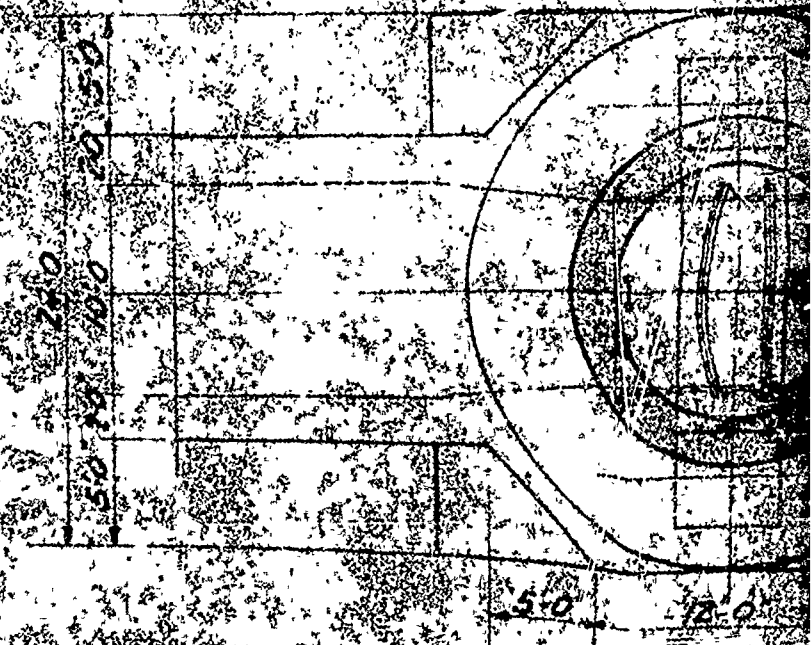
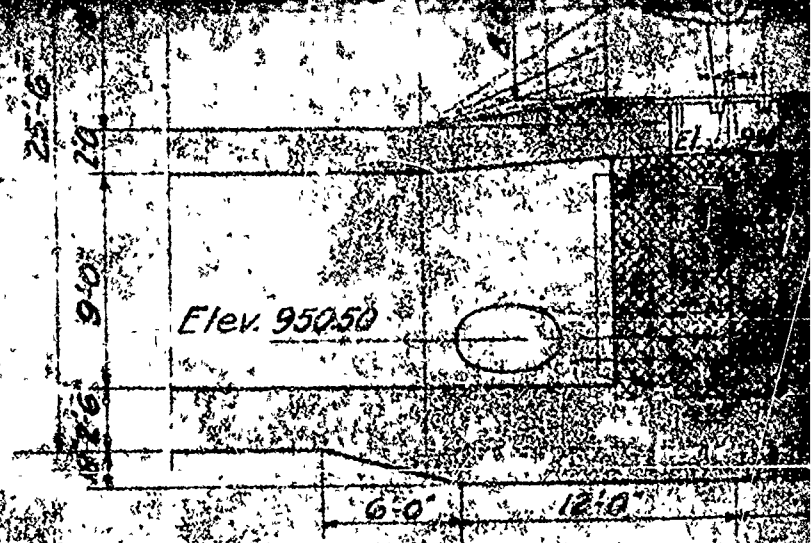
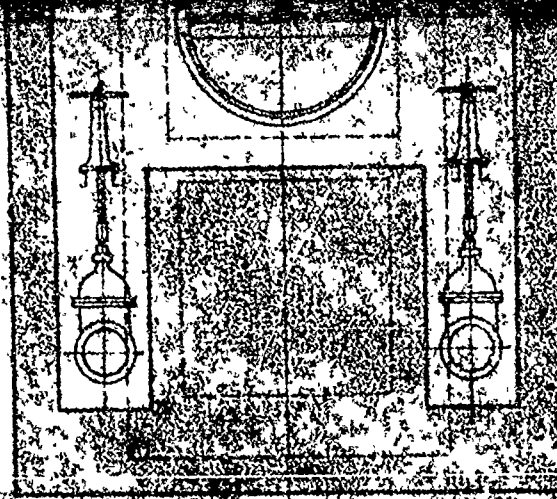
Elev. 964.50

Elev. 950.50

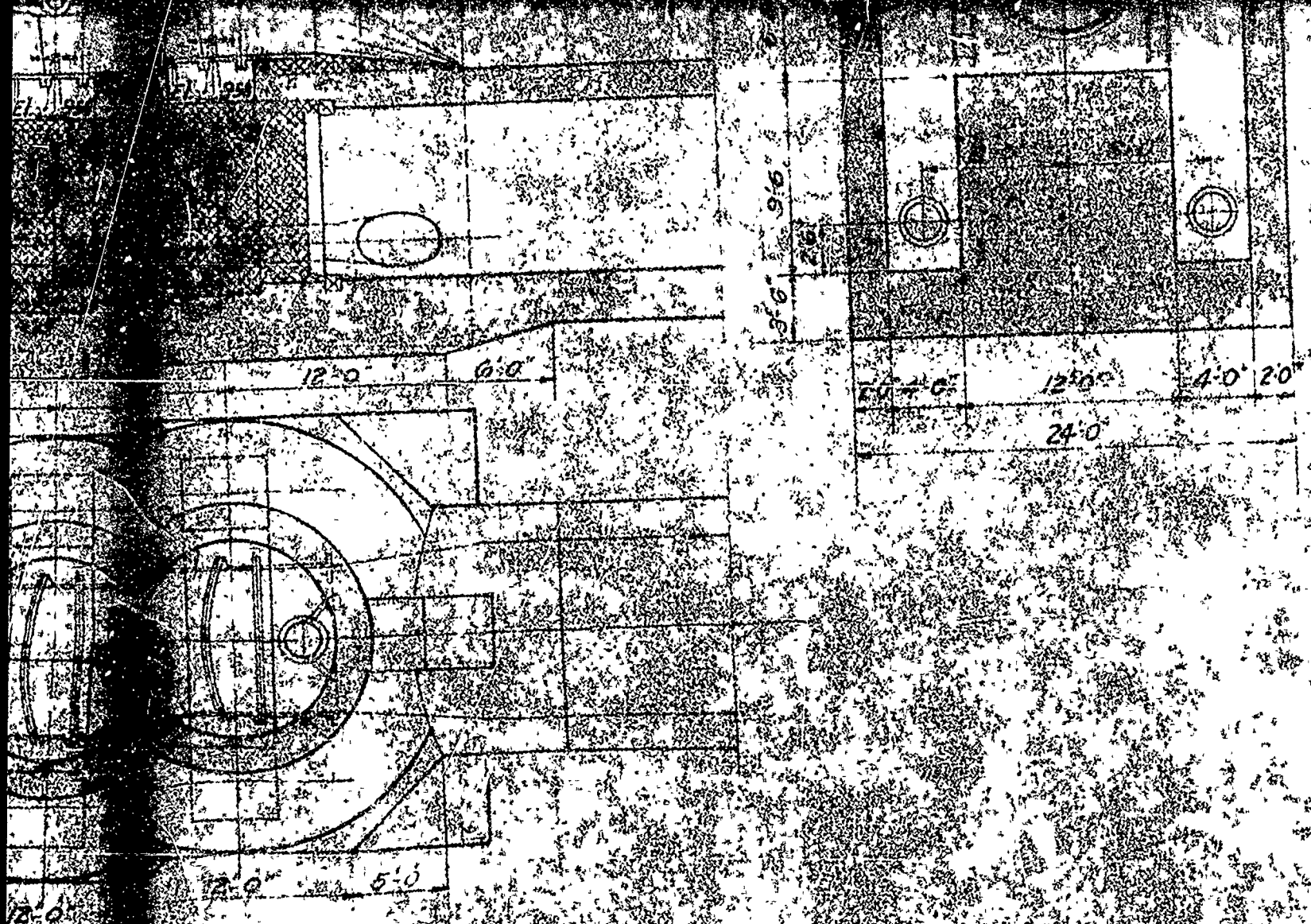








6



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AND IS SUBJECT TO RETURN ON DEMAND.



APPROVED

CHAS. T. MAIN, CONSULTING ENGR  
200 DEVONSHIRE ST.  
BOSTON, MASS.

BY

*W. H. Hill*

CATSKILL POWER CORP. MIDDLETOWN, N.Y.

REVISIONS

SWINGING BRIDGE  
DEVELOPMENT  
GATE TOWER

DESIGNED BY CHARLES T. MAIN & CO.  
ENGINEERS BOSTON, MASS.

SCALE

3 2

TENNEY & CO  
ENGRS.

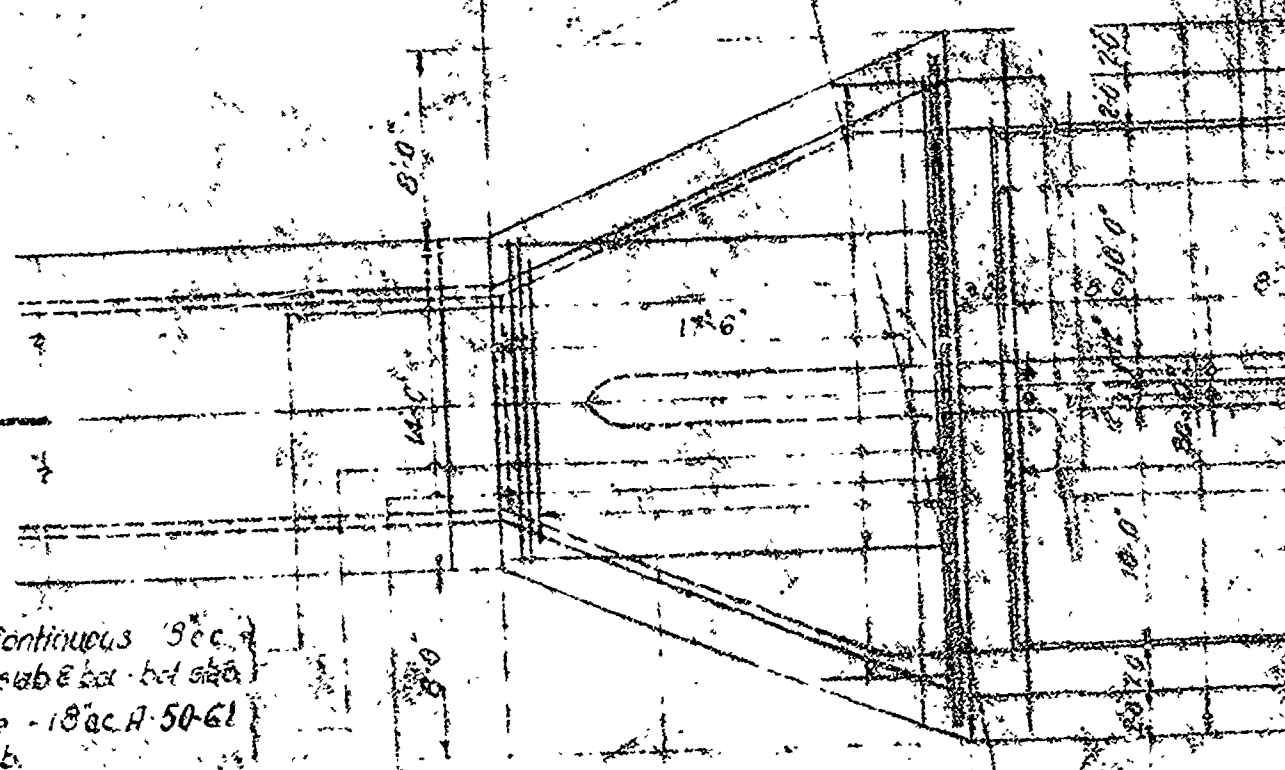
Open Joint Parous Farm Main - 12 Dia

Toe of Dam at Elev 562.0

20 # 32.6 15 ac A-48  
 bot. of slab  
 20 # 27.5 15 ac C-20  
 top of slab  
 14 # 29.6 15 ac A-49  
 bot. of slab  
 Spacers 1/2" Continuous 18 ac  
 top & bot. of slab

A1

Spacers 1/2" Continuous 3" c  
 top & bot. - top slab & bot. slab  
 12 # Variable - 18 ac A-50-61  
 top & bot. slab  
 16 # Variable - 15 ac A-62 71  
 bot. of top slab



2

B

956

954

952

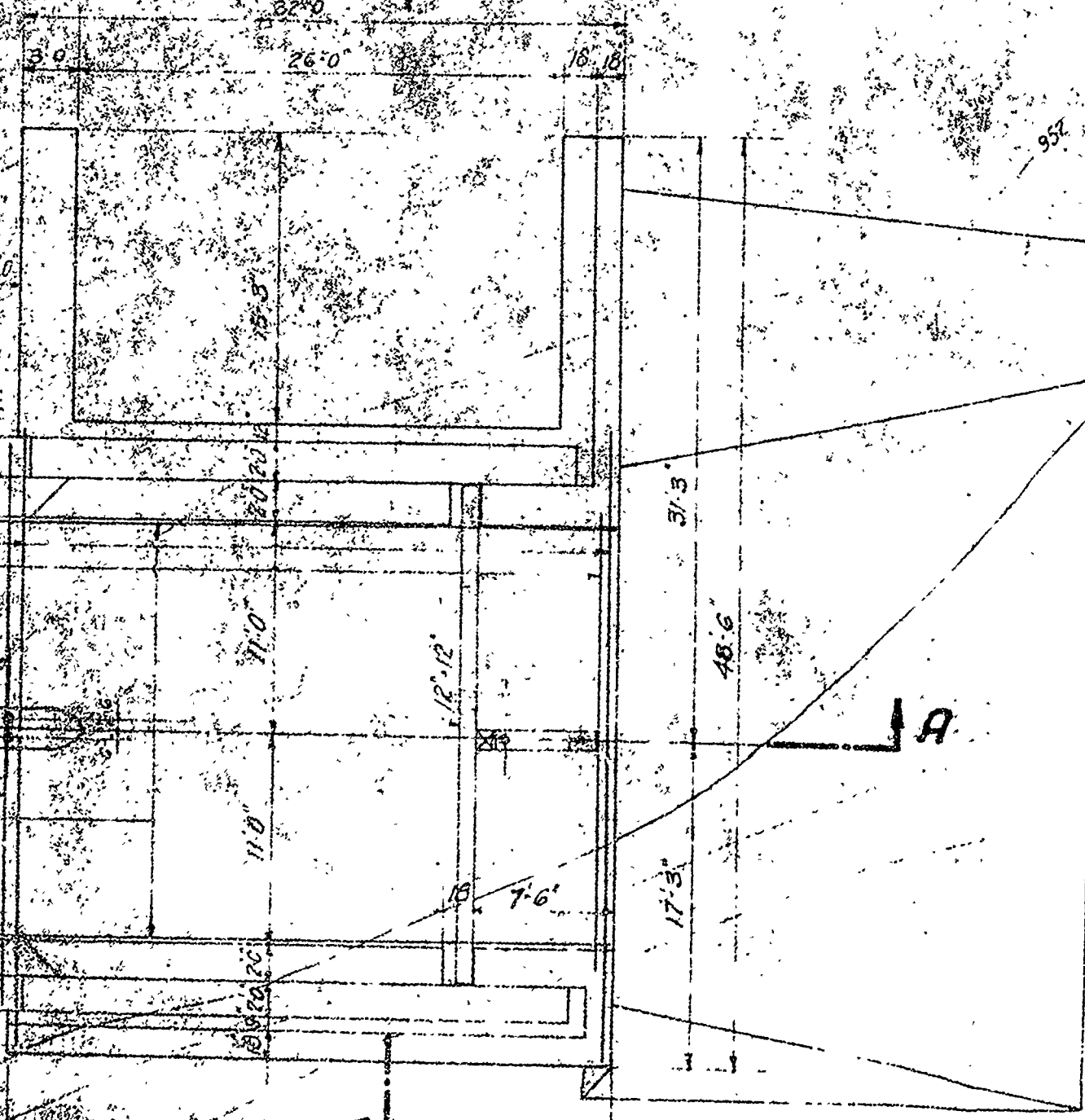
950

948

adr

A

C

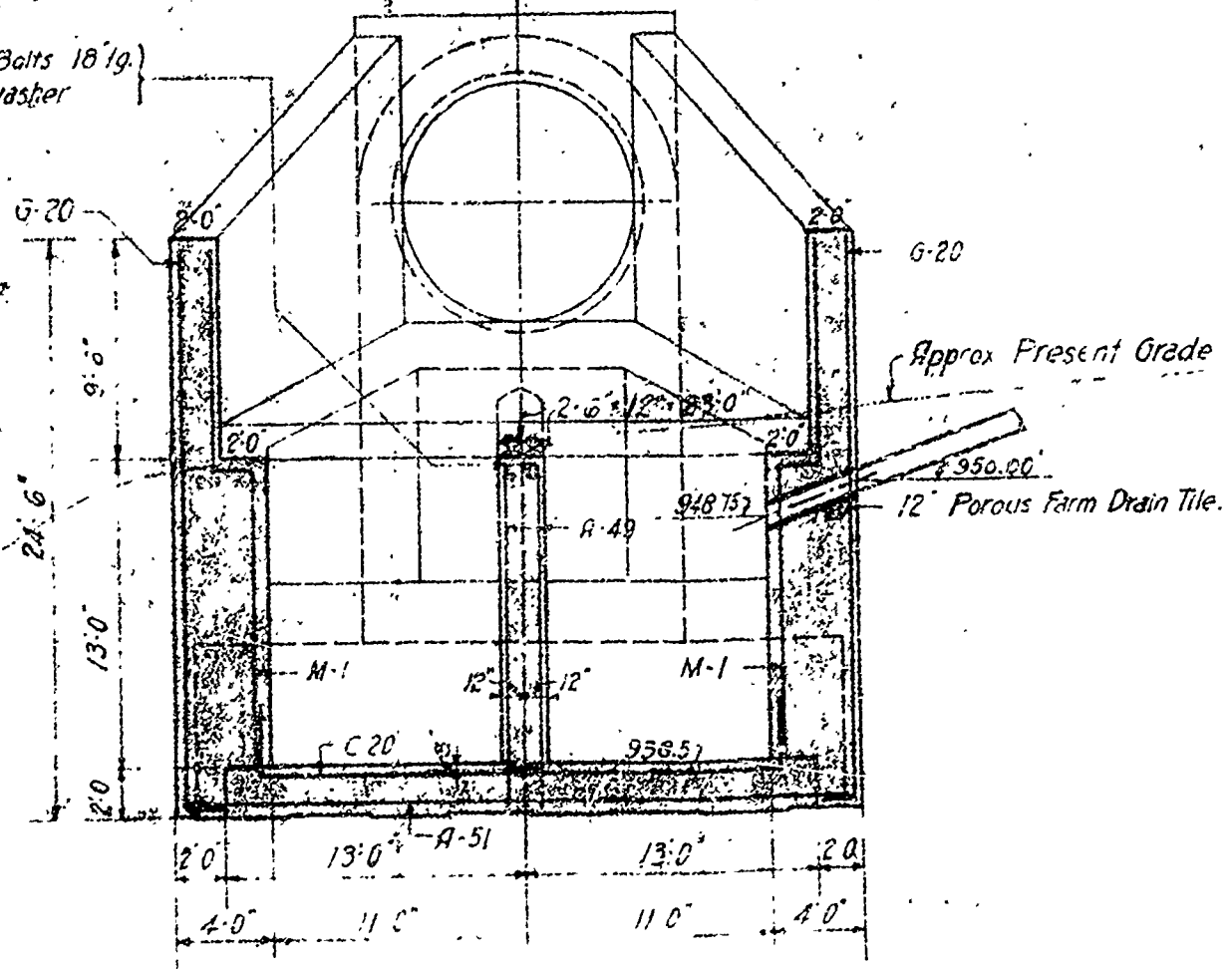


3

RE

DES

6-1" Anchor Bolts 18'lg.  
With nut & washer



"C-C"

2'6"

11'3" to 7'0"

2'9"

9'6" M-1  
12'0" M-2

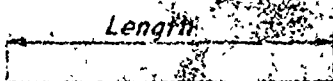
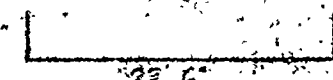
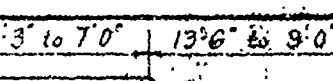
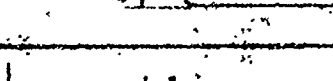
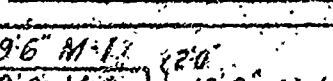
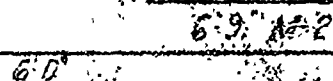
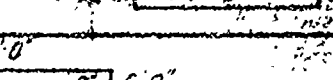
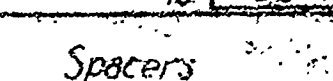
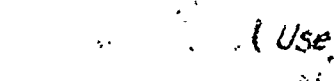
6'0"

6'0"

Sp



# REINFORCEMENT SCHEDULE

DESCRIPTION	Mark	N <sup>o</sup> Bars	Size	Length
	A-20-35	16	5/8"	16'5" to 25'0"
	A-36 to 46	11	1/2"	8'6" to 11'6"
	A-47	25	1/2"	14'6"
	A-48	26	1"	32'6"
	A-49	14	1"	29'6"
	A-50-61	12	1/2"	10'6" to 28'6"
	A-62-77	16	1"	13'6" to 29'6"
	A-78-93	16	1/2"	10'0" to 26'0"
	G-20	40	1"	27'6"
	E-20 to 35	32	5/8"	25'6" to 16'9"
		(2 each)		
	G-20	32	5/8"	26'9"
	M-1	32	5/8"	24'3"
	M-2	46	5/8"	20'9"
	N-1	23	5/8"	23'6"
	N-2	23	5/8"	24'9"
Spacers	5750 11	1/2"		

(Use deformed rods.)



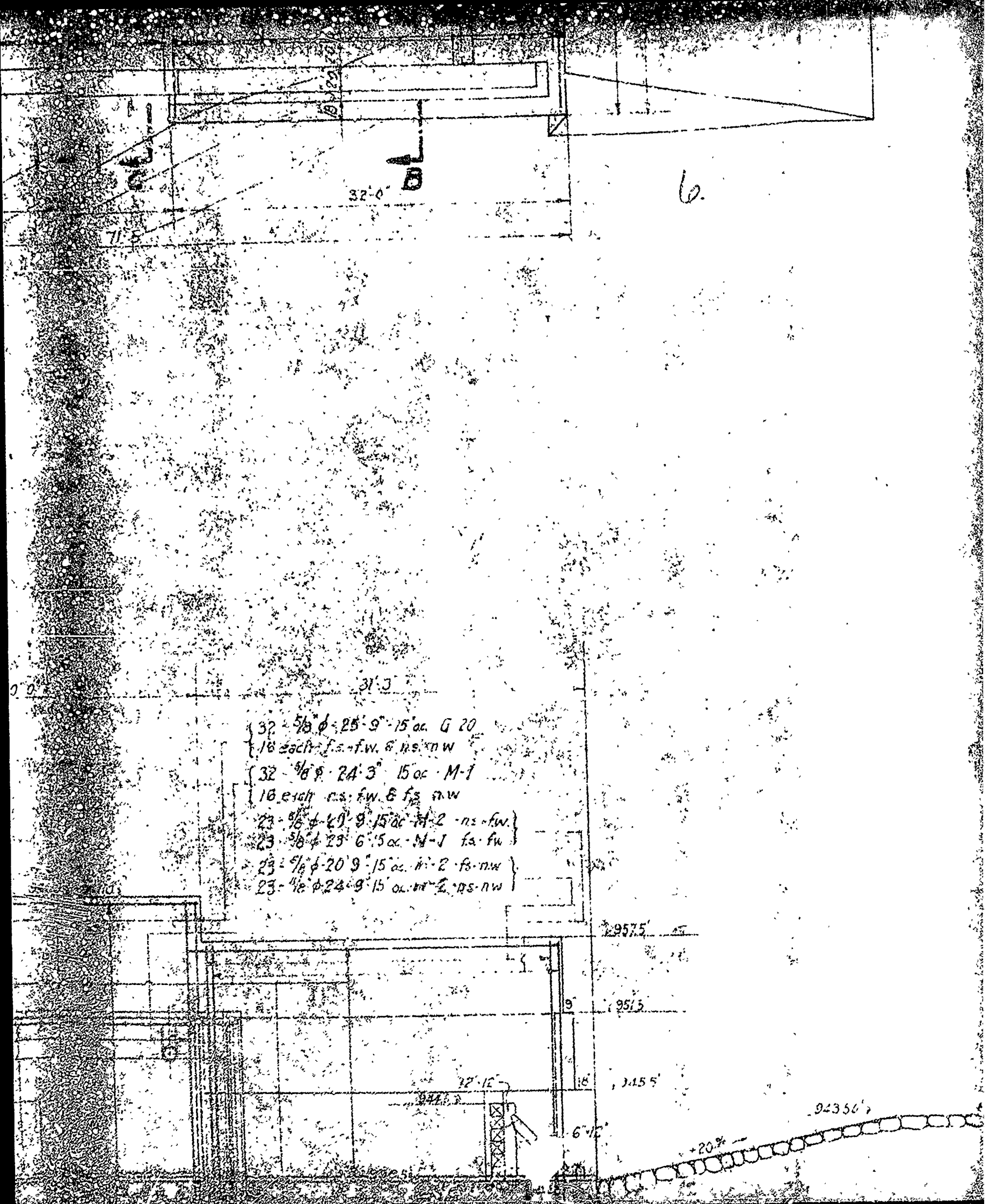
top of top slab  
 12" Variable - 18 pc. 9-50-61  
 top of bot. slab  
 16" Variable - 16 pc. 9-50-61  
 bot. of top slab  
 16" Variable - 16 pc. 9-50-61  
 top of top slab

296.0' to Dam

PLAN

Carry Longitudinal  
 Spacers 3'-0" through  
 construction joint.

32" Variable - 16 pc. 9-50-61



32'-0"

6.

31'-3"

- 32'-5/8" φ 25'-9" 15' oc G 20
- 16 each fs-fw. 8 ns-nw
- 32'-5/8" φ 24'-3" 15' oc M-1
- 16 each ns-fw. 8 fs-nw
- 23'-5/8" φ 20'-9" 15' oc M-2 ns-fw.
- 23'-5/8" φ 24'-9" 15' oc M-1 fs-fw.
- 23'-5/8" φ 20'-9" 15' oc M-2 fs-nw.
- 23'-5/8" φ 24'-9" 15' oc M-1 ns-nw.

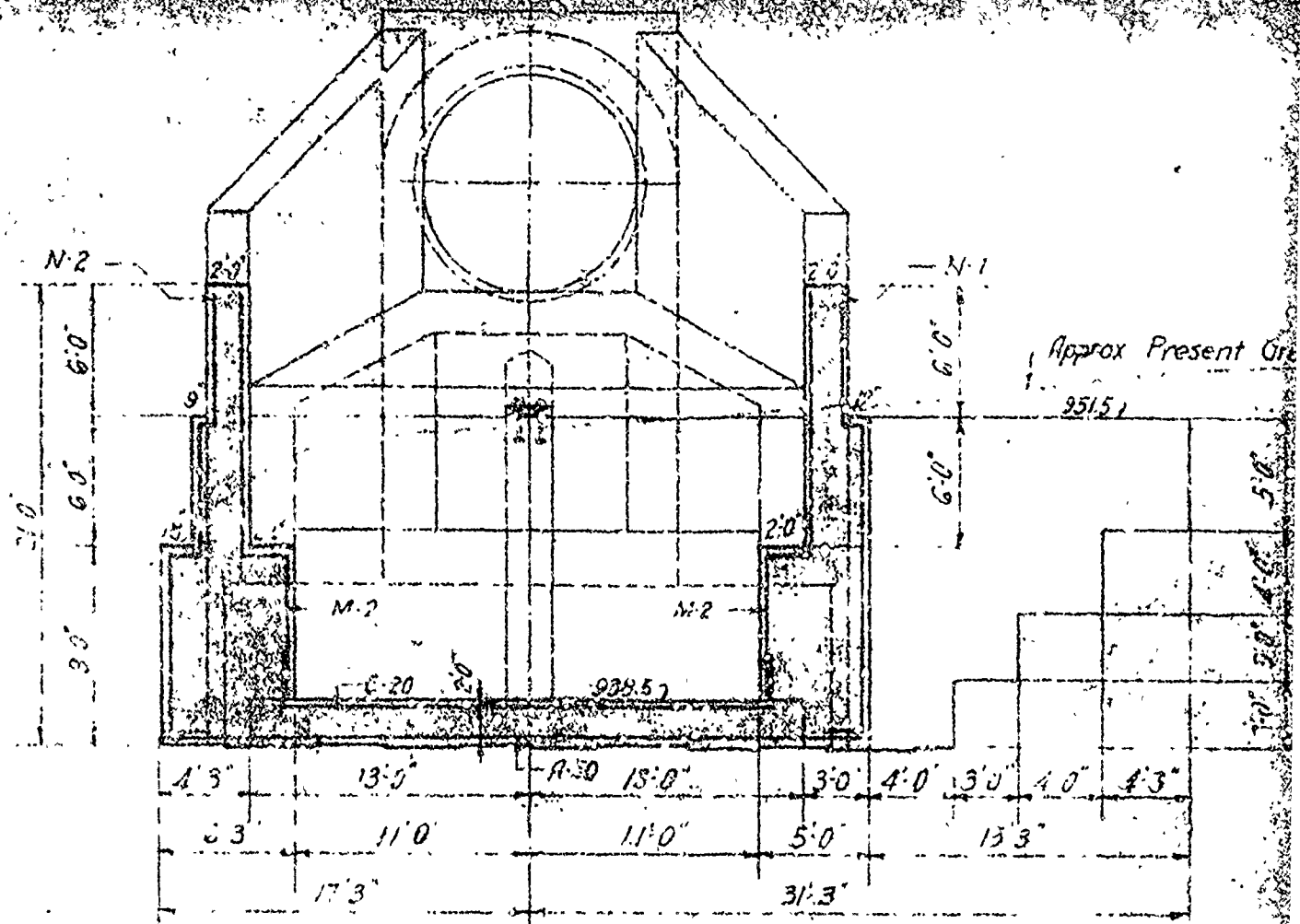
2957.5

957.5

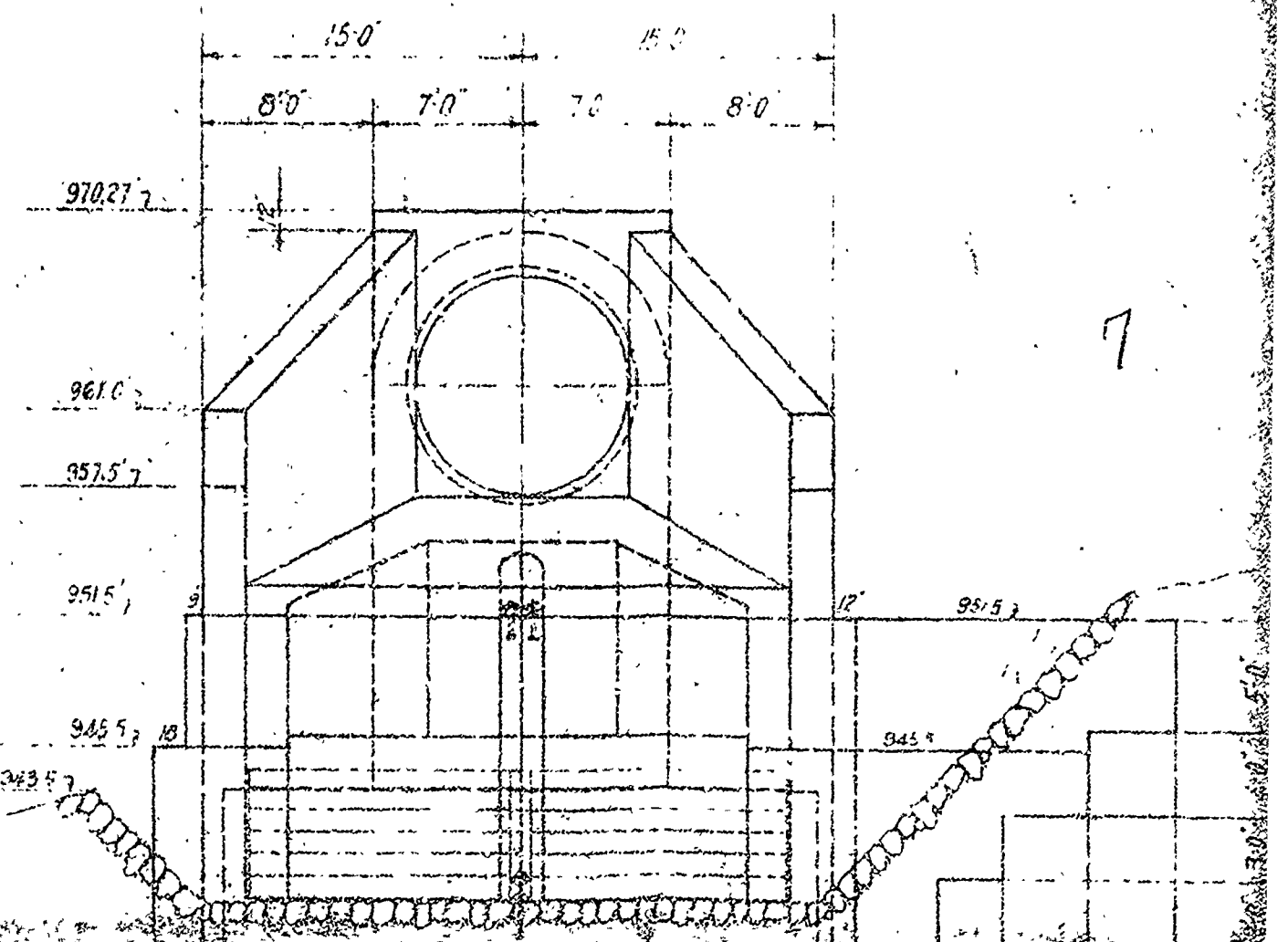
1155

92350

+20%



"B-B"



nt Grade  
ent Grade

8

Notes:-

Concrete Mix 1:2:4 (2000\*)  
All Reinforcement to be 3" from face of forms.  
For General Location & Connecting Structures  
see Drawings KK-3-17, KK-3-26 & KK-3-28

APPROVED:

CHAS. T. MAIN, CONSULTING ENGINEER

11 each ns. 16 each ns. 16 each ns.  
14 each ns. 16 each ns. 16 each ns.  
32-516 Variable 1-20-35  
16 each ns. 16 each ns. 16 each ns.

SECTION 9A

ORDER NUMBERS



with nut & washer

58 59  
Spacers  $\frac{1}{2}$ "  $\phi$  Continuous - 18" o.c.  
n.s. & f.s. - n.w. & s.w.  
Spacers  $\frac{1}{2}$ "  $\phi$  Continuous - 18" o.c.  
n.s. & f.s. center wall

AA-AA

20-0	3 0	4 0	4 3
3 3			

DOWNSTREAM ELEVATION

CA
REV

THIS DRAWING IS THE PROPERTY OF CHARLES H. TENNEY & CO.  
AND IS SUBJECT TO RETURN ON DEMAND.

200 DEVONSHIRE ST.  
BOSTON, MASS.  
BY *Chas. H. Tenney*

CA

CATSKILL POWER CORP. MIDDLE TOWN, N.Y.

REVISIONS

REVISIONS

SWINGING BRIDGE  
DEVELOPMENT  
CONDUIT OUTLET

PREPARED BY CHARLES H. TENNEY & CO.  
ENGINEERS BOSTON, MASS.

SCALE

$\frac{1}{8}$ " = 1'-0"

Oct. 1925

KK 3 27

Drawn by Titled by Checked by

RAM OVER

Estimated by

Approved by

*W. F. Hill*

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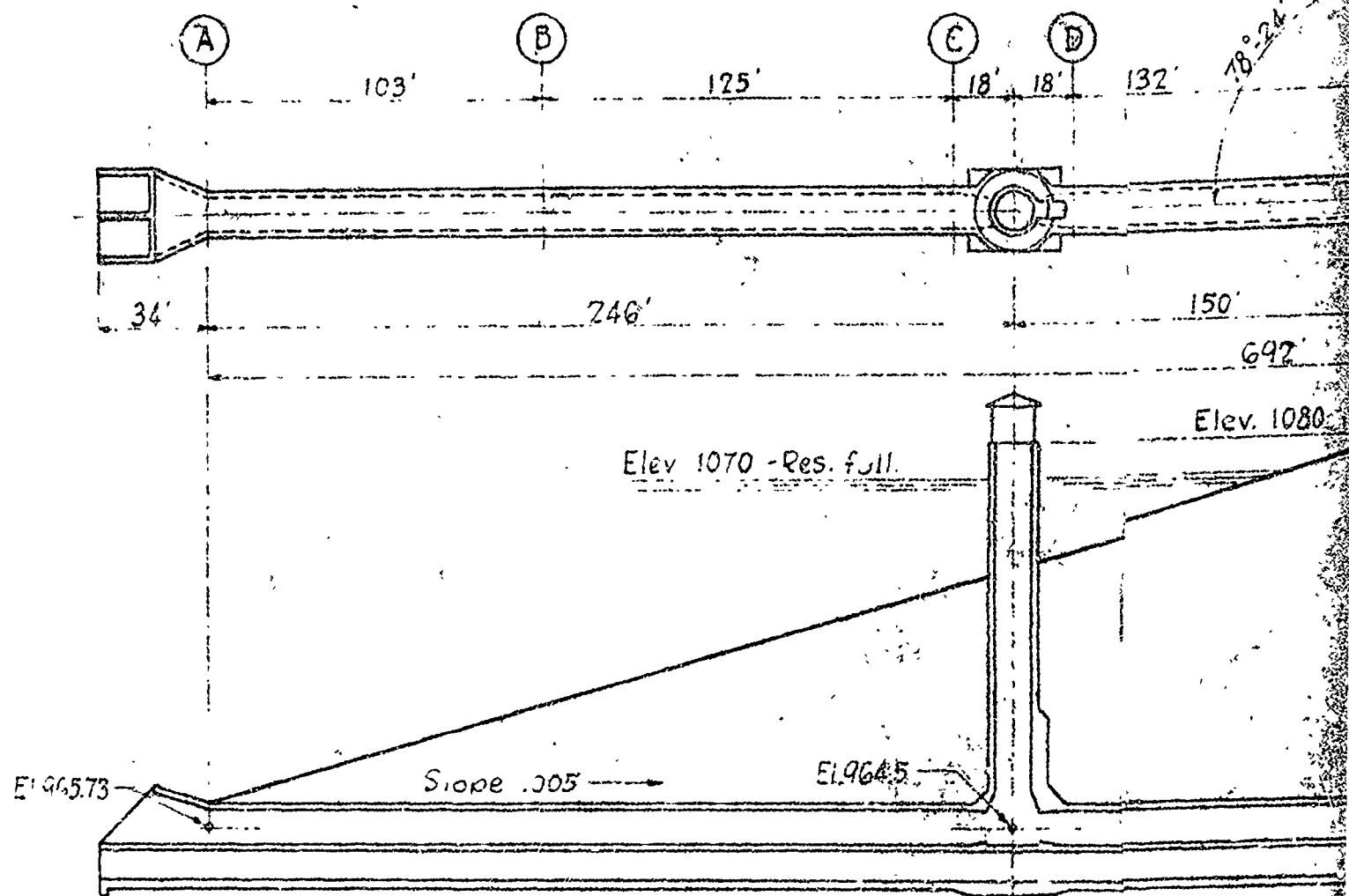
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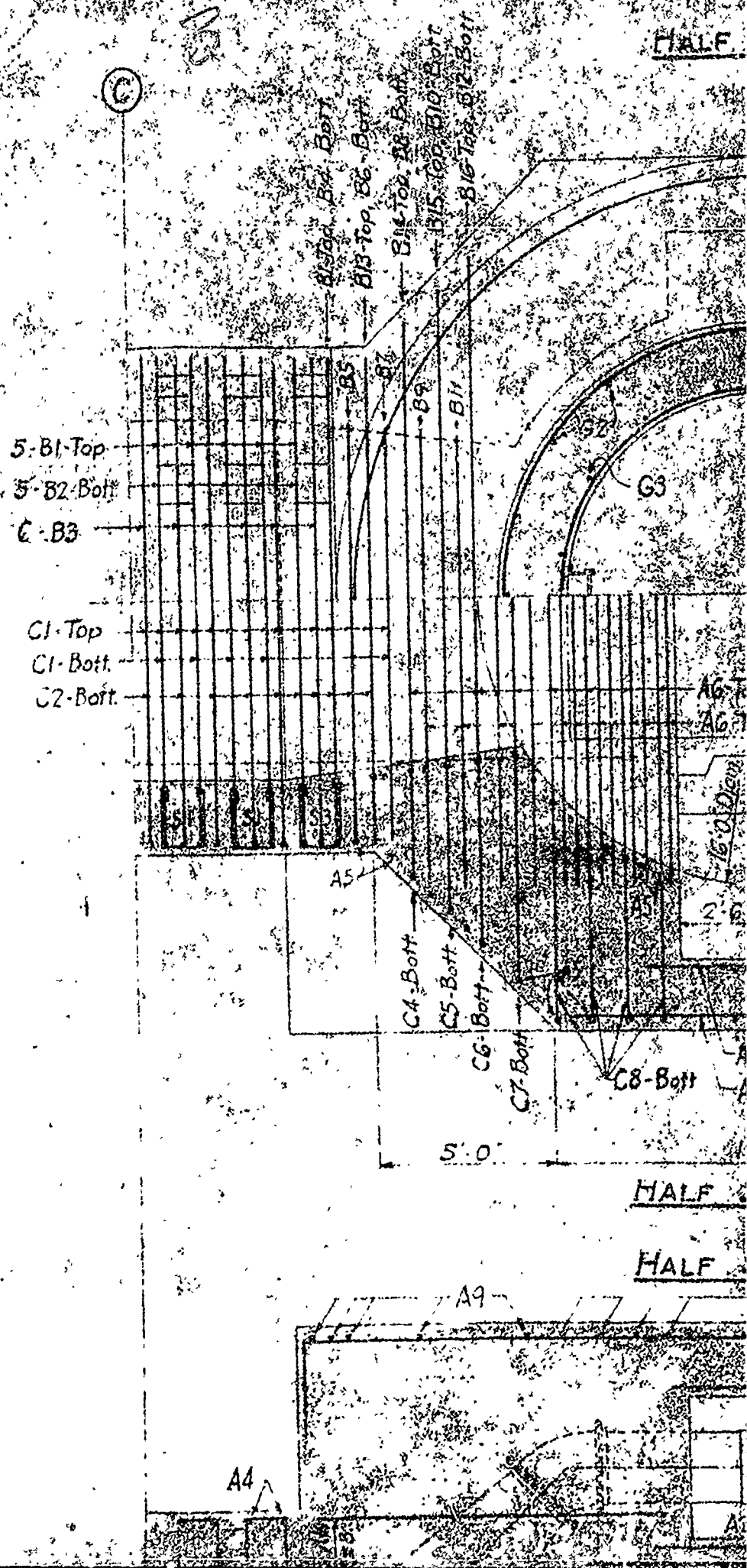


# SECTION

DIAGRAM	MARK	NO. REQ'D	SIZE	LENGTH	DIAGRAM	MARK	NO. REQ'D	SIZE	LENGTH
	A1	45	1"φ	4'-3"		B1	2	1"φ	30'-0"
	A2	128	1"φ	7'-0"		B2	2	1"φ	26'-0"
	A3	41	1"φ	13'-9"		B4	2	1"φ	25'-5"
	A4	36	1"φ	14'-4"		B5	2	1"φ	25'-3"
	A5	96	1"φ	11'-6"		B6	2	1"φ	25'-1"
	A6	70	1"φ	16'-0"		B7	2	1"φ	24'-10"
	A7	18	1"φ	23'-9"		B8	2	1"φ	24'-8"
	A8	13	1"φ	18'-0"		B9	2	1"φ	24'-5"
	A9	56	1"φ	10'-9"		B10	2	1"φ	24'-3"
	A10	42	1"φ	10'-0"		B11	2	1"φ	24'-1"
	G1	18	1"φ	9'-3"		B12	2	1"φ	23'-11"
	G2	20	8"φ	9'-0"		B15	4	1"φ	20'-8"
						B16	4	1"φ	22'-7"
						C1	35	1"φ	16'-7"



MARK	MARK	NO. REQ'D	SIZE	LENGTH	a	b
F1	F1	1	1"φ	18'-0 $\frac{1}{2}$ "	2'-0 $\frac{3}{4}$ "	2'-7 $\frac{1}{2}$ "
F2	F2	1	1"φ	18'-3"	2'-2 $\frac{1}{4}$ "	2'-8 $\frac{1}{2}$ "
F3	F3	1	1"φ	18'-5 $\frac{1}{2}$ "	2'-3 $\frac{3}{4}$ "	2'-9 $\frac{1}{2}$ "
F4	F4	1	1"φ	17'-4"	1'-9"	2'-3"
F5	F5	2	1"φ	20'-11"	3'-5"	3'-11 $\frac{1}{2}$ "
F6	F6	2	1"φ	21'-1"	3'-6"	4'-0 $\frac{1}{2}$ "
F7	F7	11	1"φ	21'-2 $\frac{1}{2}$ "	3'-7"	4'-1 $\frac{1}{4}$ "
F8	F8	11	1"φ	21'-2 $\frac{1}{2}$ "	3'-7"	4'-1 $\frac{1}{4}$ "
F9	F9	13	1"φ	18'-7"	2'-9 $\frac{1}{2}$ "	3'-1"
F10	F10	13	1"φ	18'-7"	2'-9 $\frac{1}{2}$ "	
H1	H1	42	1 $\frac{1}{2}$ "φ	16'-6"	11'-6"	
H2	H2	6	2"φ	13'-6"	10'-6"	
H3	H3	6	2"φ	12'-6"	9'-6"	
H4	H4	6	2"φ	11'-6"	8'-6"	
H5	H5	4	3"φ	15'-0"	8'-0"	
H6	H6	4	3"φ	14'-3"	7'-6"	

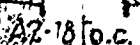


5



## SECTION F-F

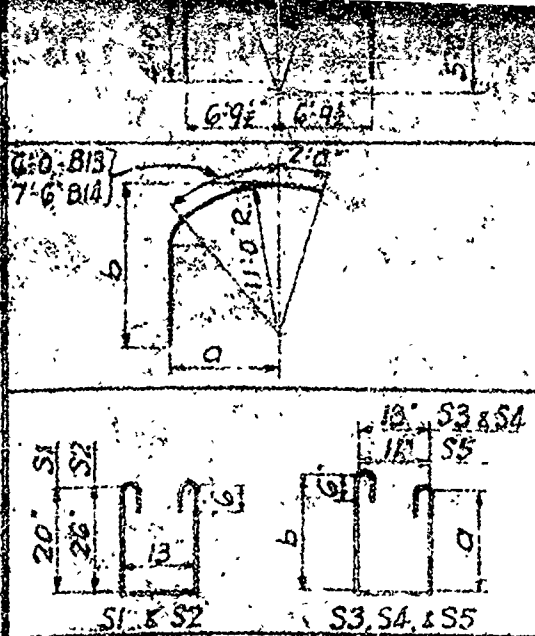
AZ-18 to c.







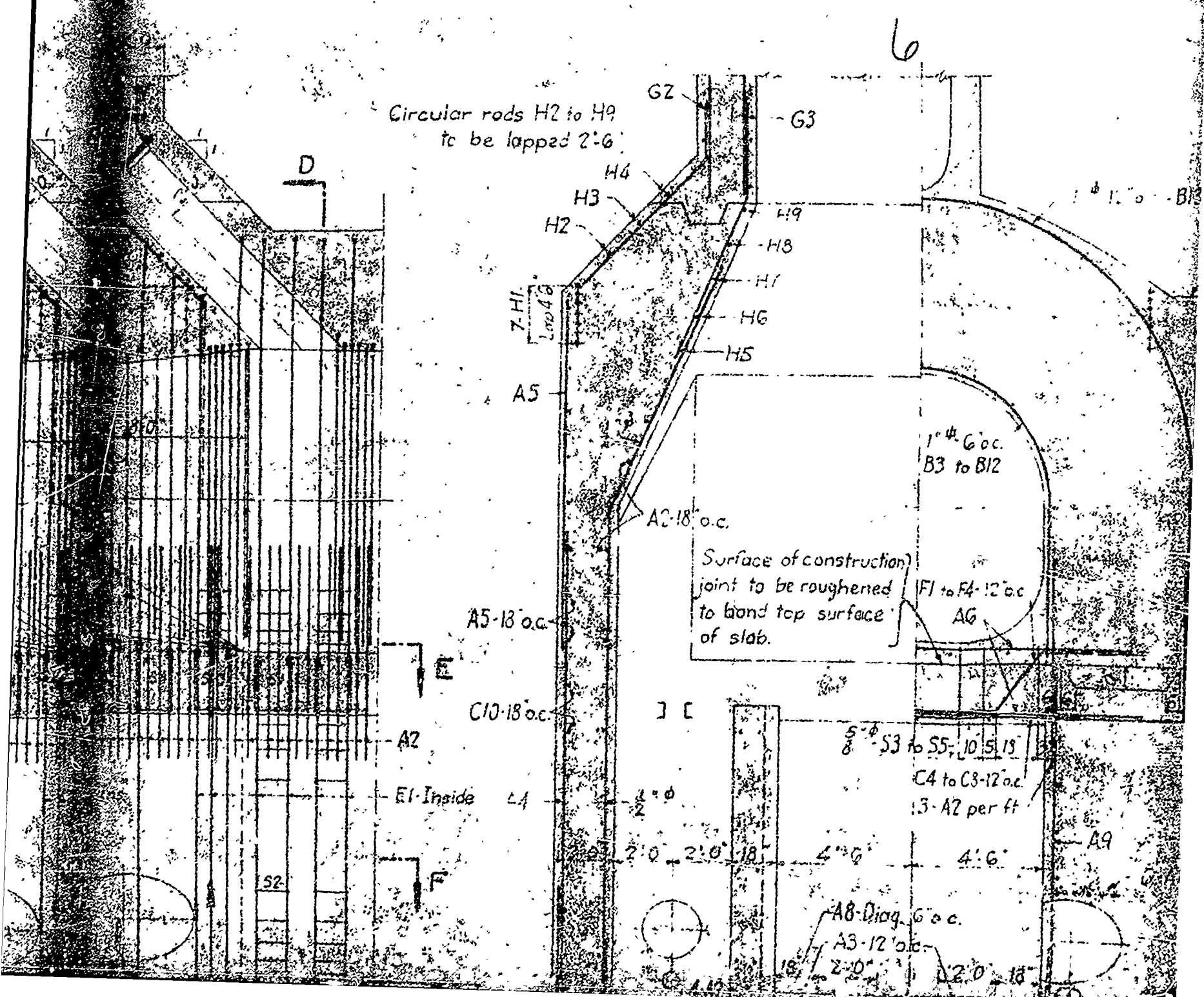
12	16	8-9 1/2	13-11
7 1/2	16	9-7 1/2	16-10
7	13-7	18	
7	13-7	5-4	
7	15-7	5-4	
7	17-7	5-4	
7	19-7	5-4	
17	21-7	5-4	
23-7	23-7	5-4	
3-7	13-7	6-6	
6-6	26-6	2-9	



B13	4	1"φ	19-1	6-9 1/2	12-6
B14	4	1"φ	20-8	7-7 1/2	13-6
S1	60	5"φ	3-10		
S2	64	5"φ	6-10		
S3	30	5"φ	6-1	20-8	22-1
S4	6	5"φ	6-7	23-1	25-1
S5	6	5"φ	7-0	26-1	28

Longitudinals and  
Spacers

Note:-  
All reinforcement



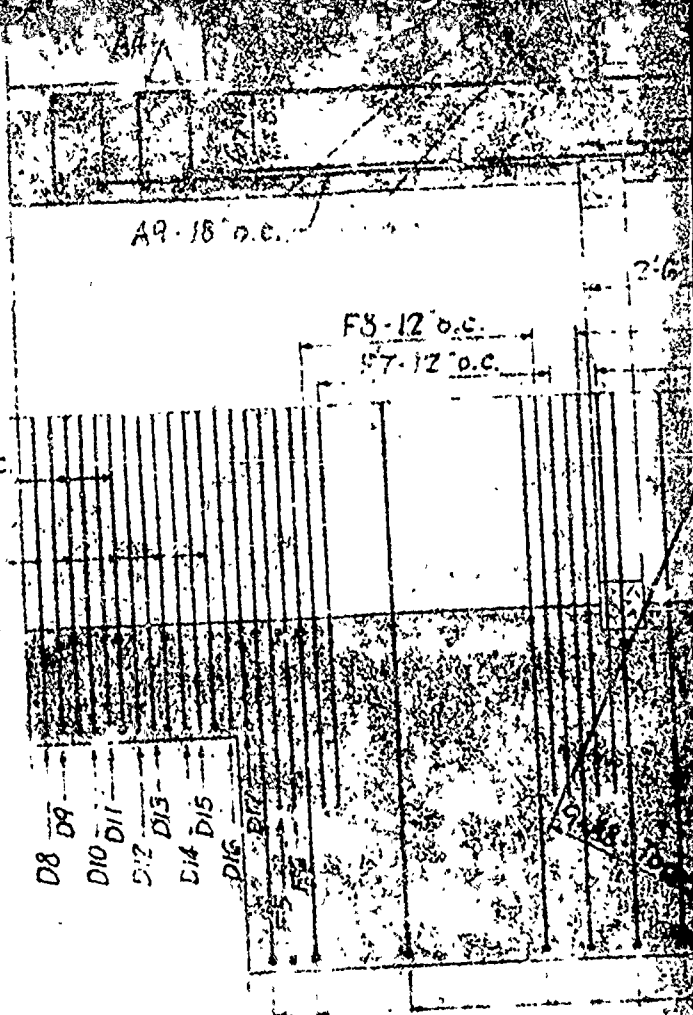
H4	6	11'-6"	8'-0"
H5	4	15'-0"	8'-0"
H6	4	14'-3"	7'-6"
H7	4	13'-6"	7'-0"
H8	4	12'-9"	6'-6"
H9	4	12'-0"	6'-0"

Longit. Spacers	1	8'-0"	
	1	5'-0"	

These include longitudinals and spacers not shown on drawing, to be used as required.

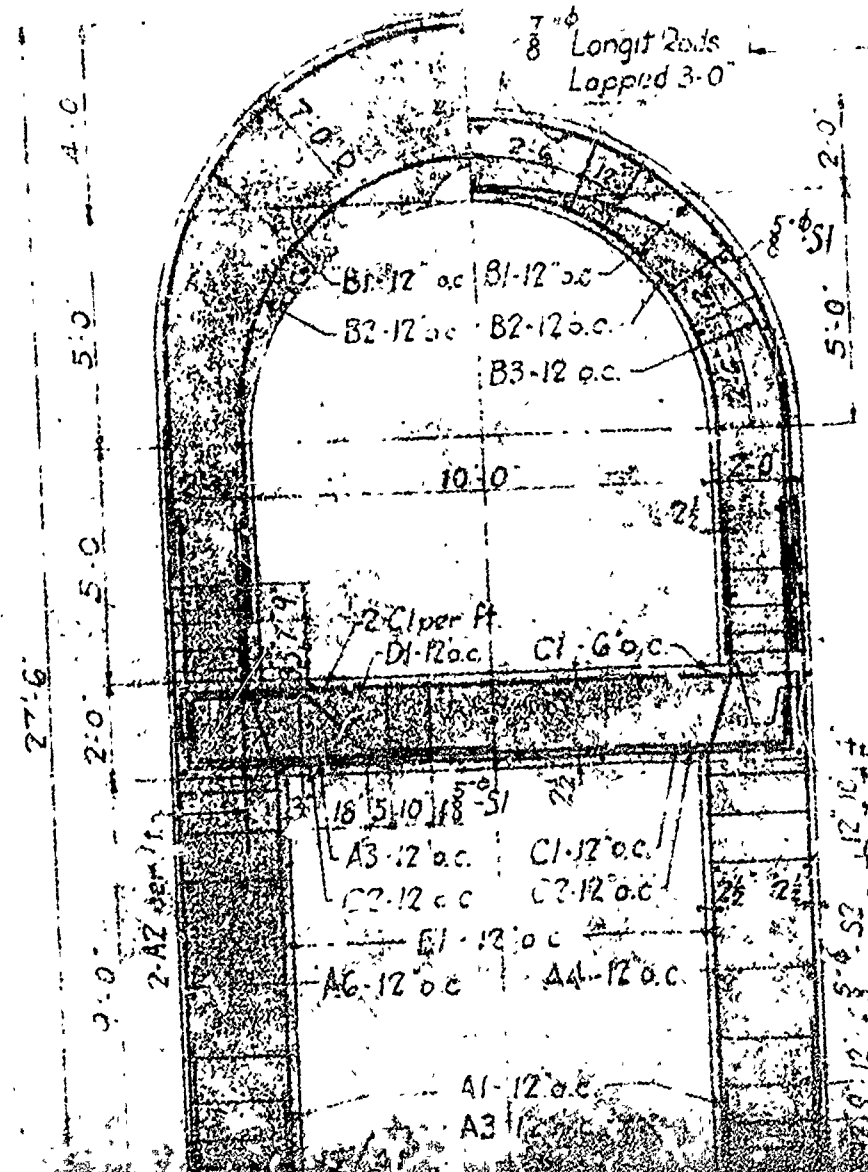
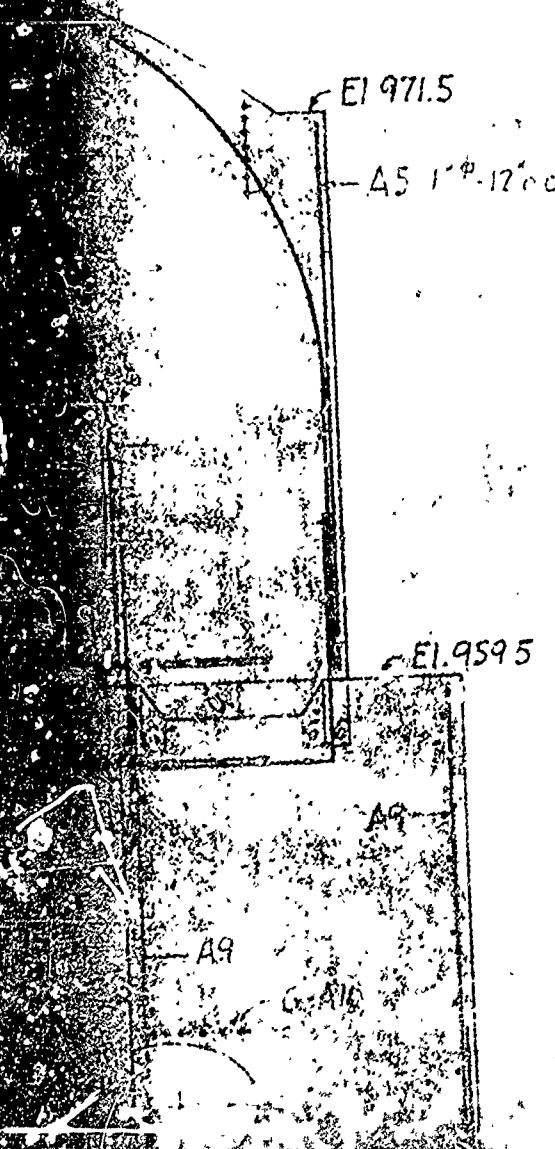
Reinforcement to be deformed rods

A3-Tops 12' o.c.  
from (C) to (D)  
B4-Bott.



7

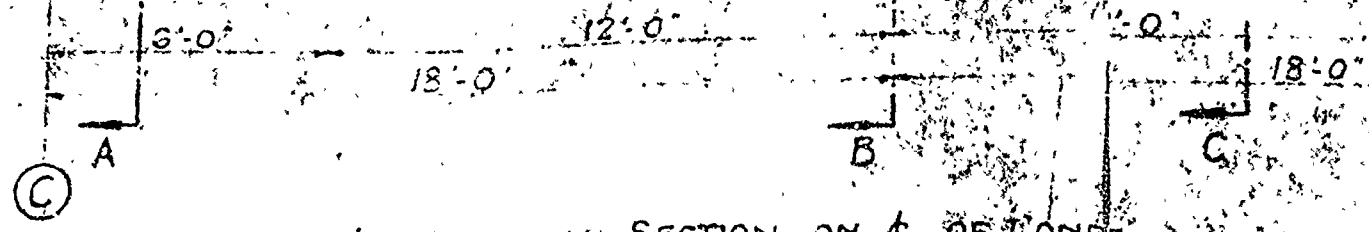
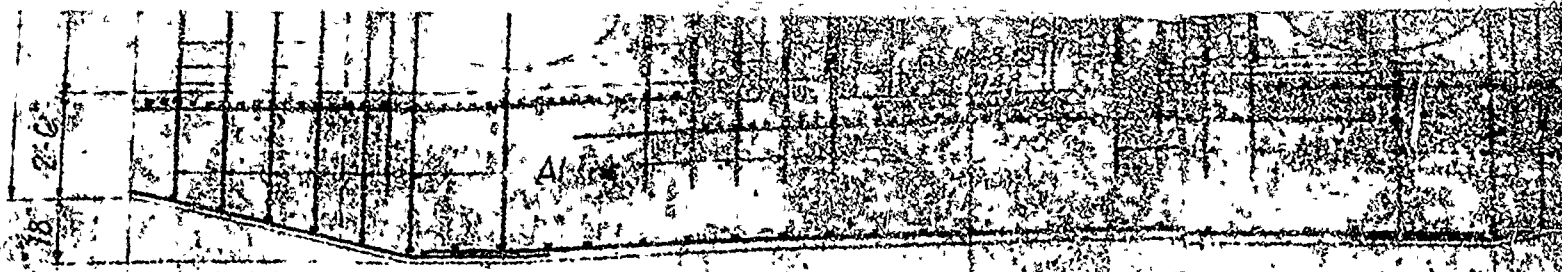
7' 1" o B13 to B16











LONGITUDINAL SECTION ON C OF CONDT

9

ORDER NUMBERS



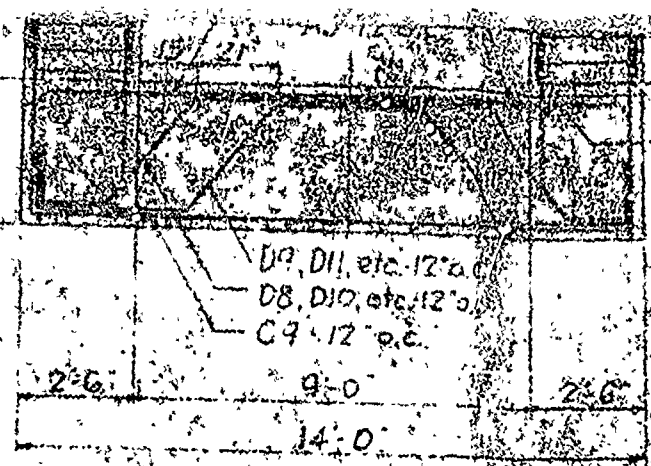
HALF SECTION B-B

HALF SECTION

10



SECTION C-C



See Sheet K.K-3-20  
for details of  
construction joint

HALF SECTION D-D

HALF SECTION A-A

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200 DEVONSHIRE ST.  
BOSTON, MASS.

12  
CATSKILL POWER CORP. - MIDDLE TOWN, N.Y.

REVISIONS

SWINGING BRIDGE

DEVELOPMENT

CONDUIT SHEET NO. 1

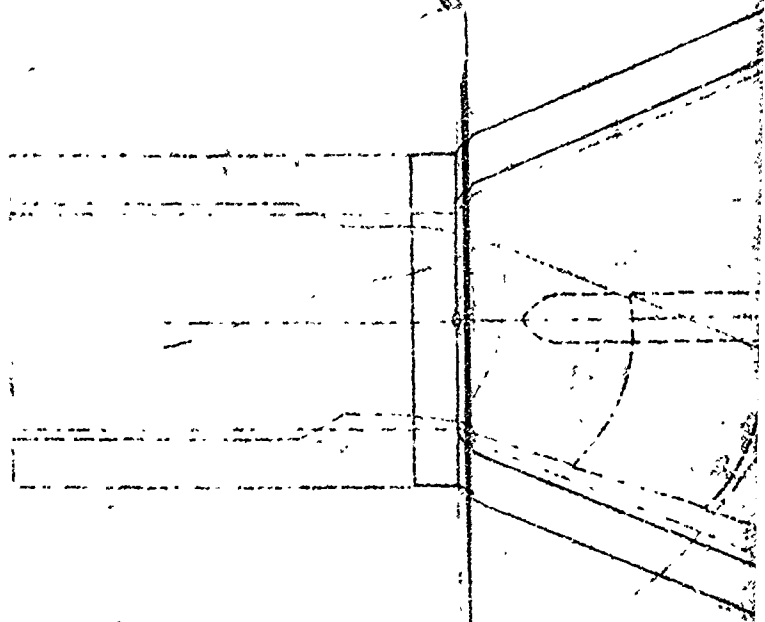
PREPARED BY CHARLES H. TENNEY & CO.  
ENGINEERS BOSTON, MASS.

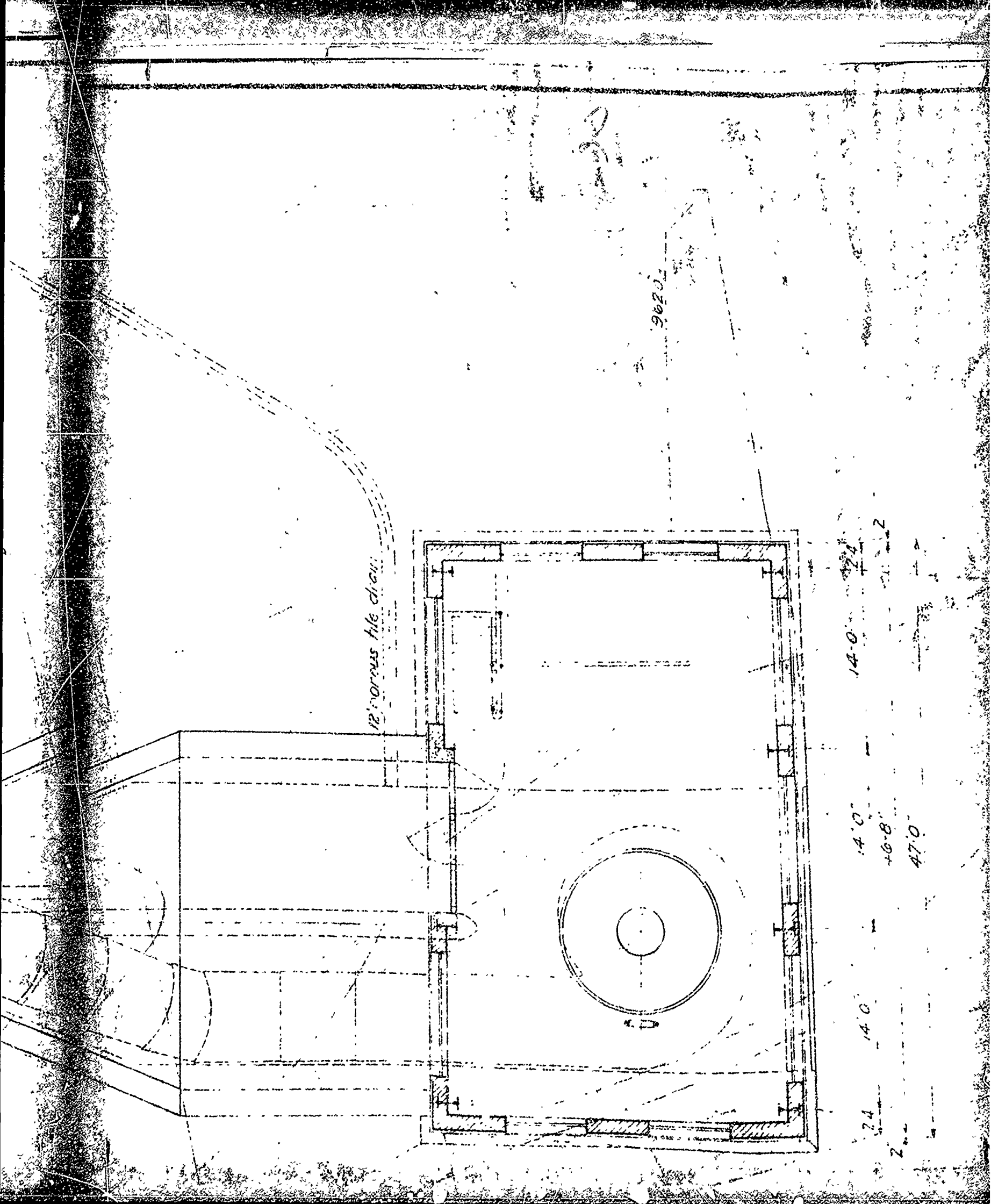
SCALE

1" = 10'

KK 3 25

Downstream toe of Dam at Elev 962.1'





12' porous tile drain

9020

14'-0"

4'-0"

16'-8"

14'-0"

47'-0"



3

952

952

950

948

946

9435

Present Rivers Edge

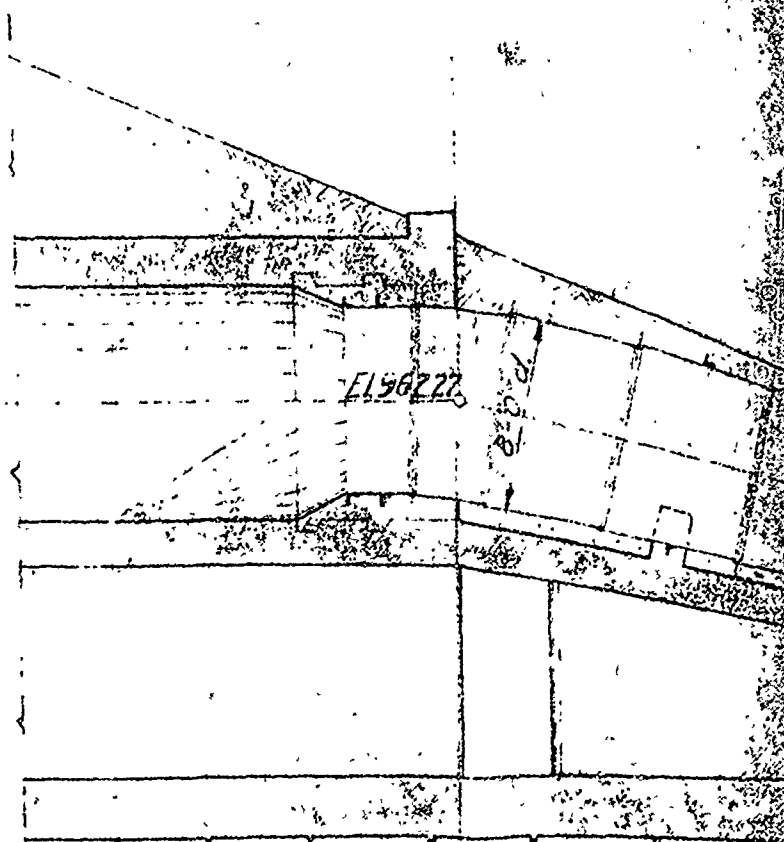


4

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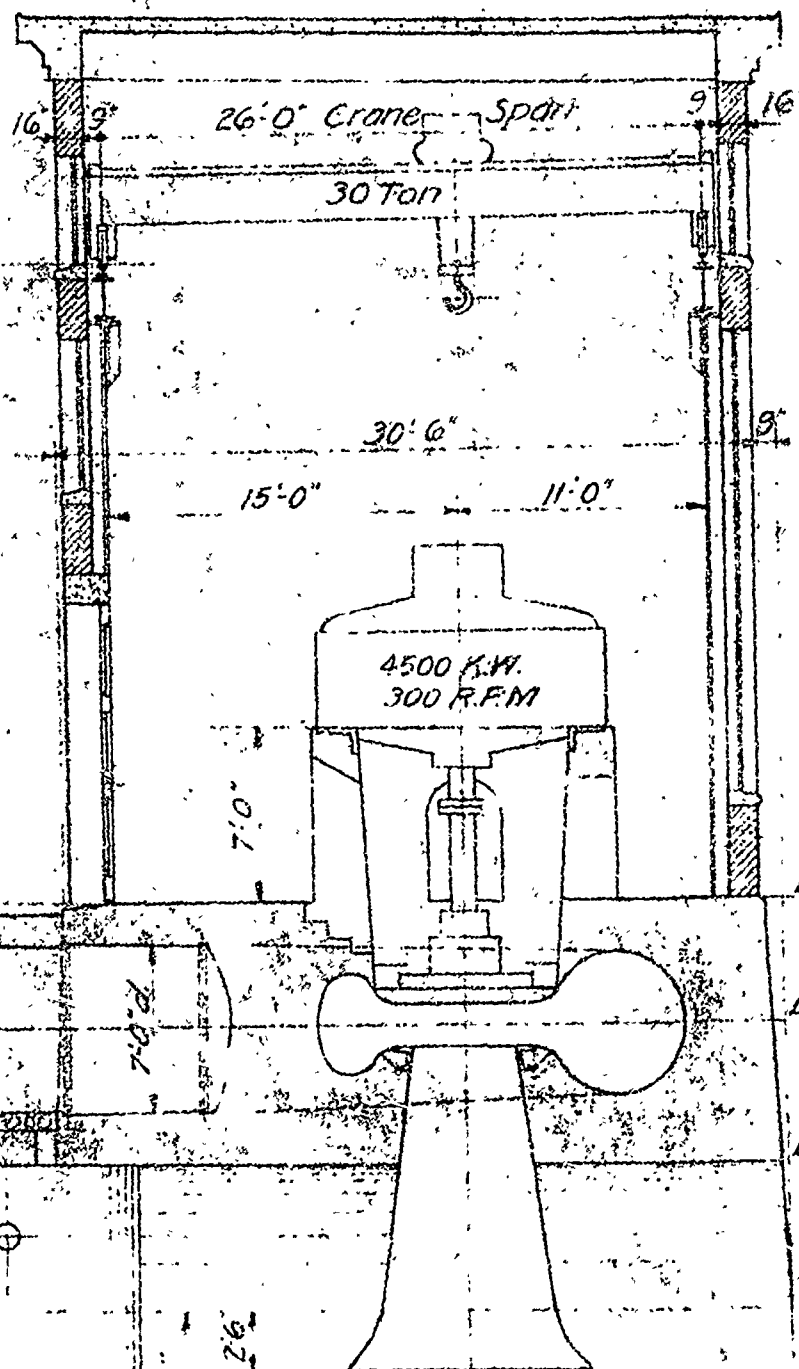
296'-0" to  $\phi$  of Dam

20'-0"



PLAN

6



EI 962.5

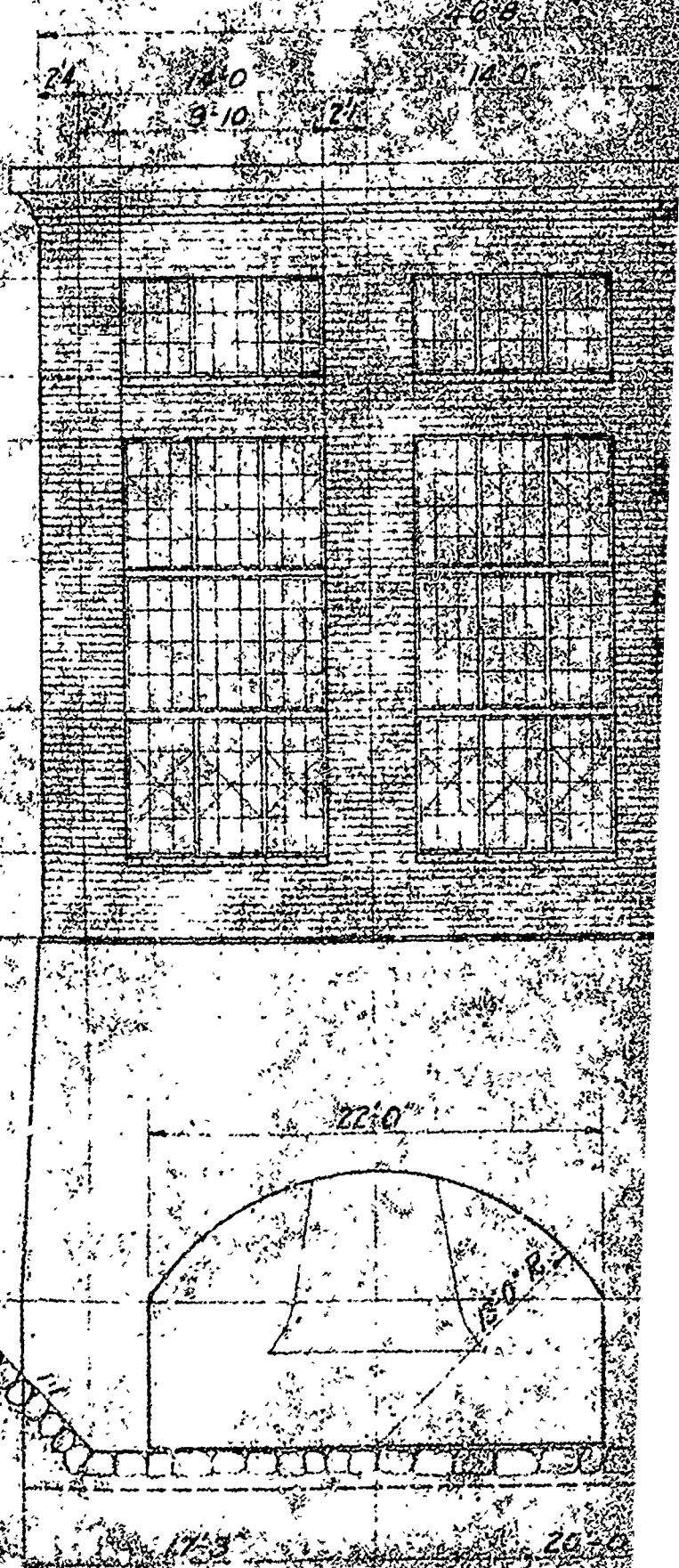
EI 957.5

EI 951.5

T.W. EI 945.5

938.5

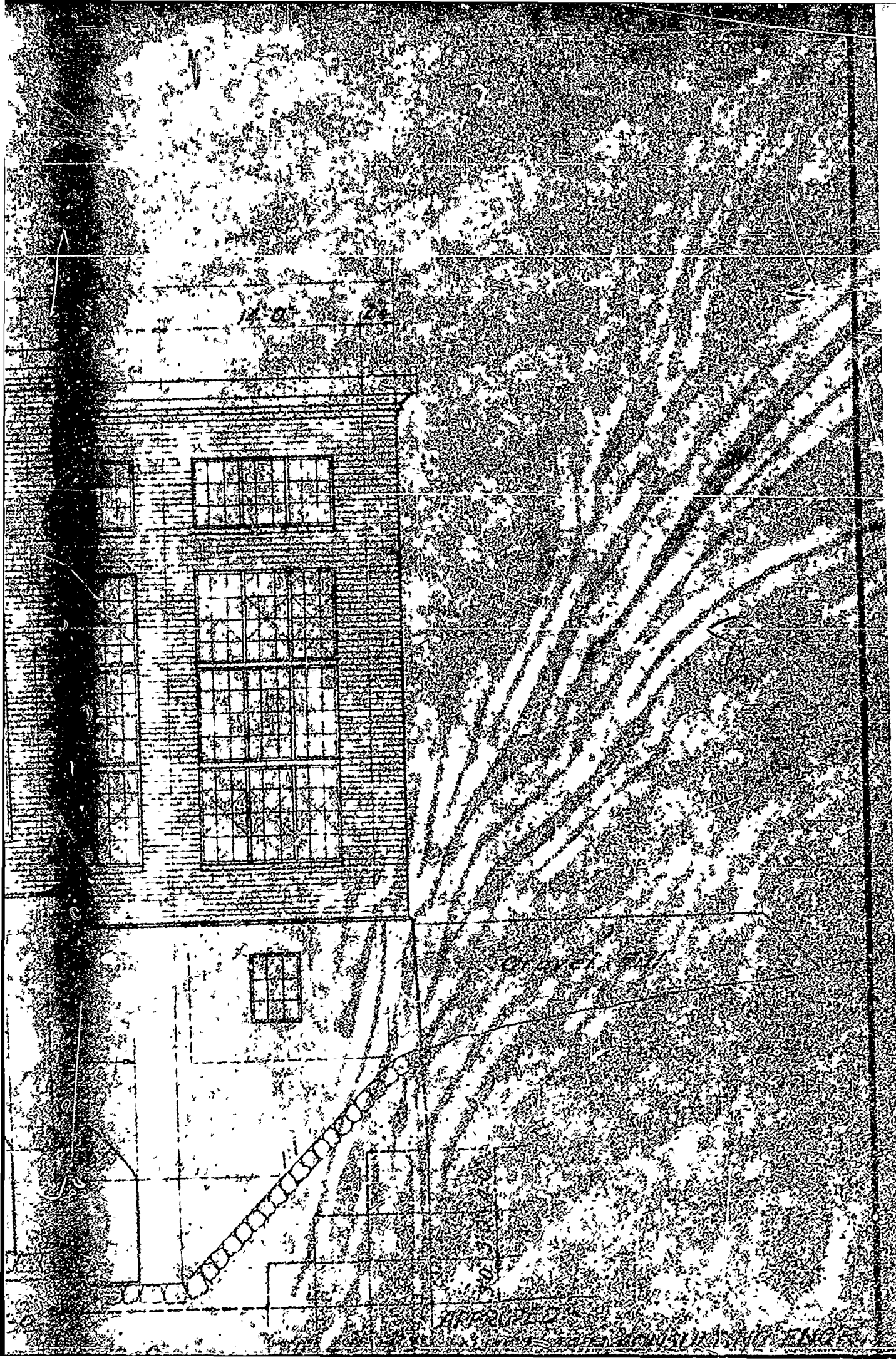
7



9455

El. 943.5





18-0

9

ORDER NUMBERS

T.W. E1 2455

238.5

65.37

SECTION

10



9455

100

9455

El. 943.5

25'0"

17'3"

20'0"

48'6"

ELEVATION

CATSA

REVISION

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AND IS SUBJECT TO RETURN ON DEMAND

ELEVATION

CATSKILL POWER CORP. MIDDLETON, N.Y.	
REVISIONS	SWINGING BRIDGE
	DEVELOPMENT
	POWER PLANT CONSTRUCTION
	ESTIMATES
	ENGINEERING
	1/2 IN. = 1' 0"
	KMS